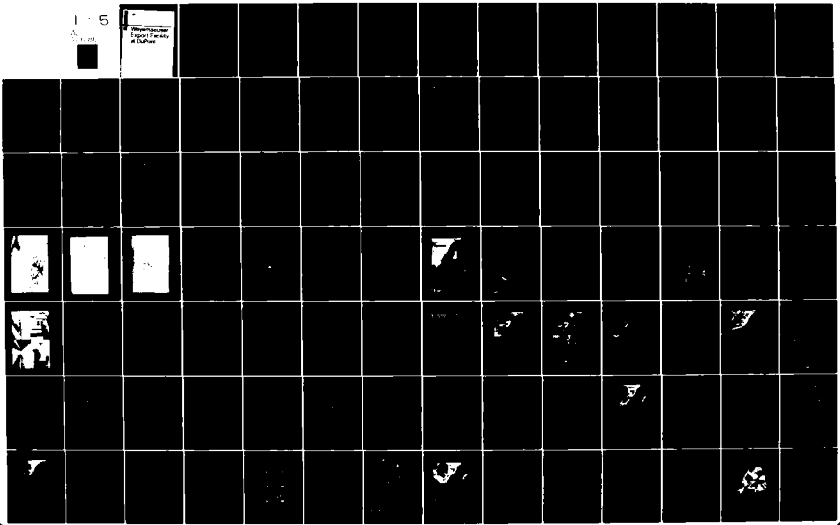
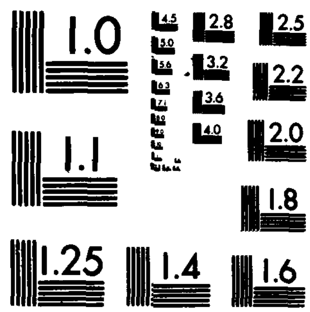
AD-A116 180   URS CO SEATTLE WA   F/G 13/2
WEYERHAEUSER EXPORT FACILITY AT DUPONT. VOLUME I.(U)
MAY 82

UNCLASSIFIED   NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

yerha
ort F
uPon

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO. AD-A116 180

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)

Final environmental impact statement, Weyerhaeuser export facility at DuPont, Volume I.

5. TYPE OF REPORT & PERIOD COVERED

Final

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS

URS Company
Fourth and Vine Bldg.
Seattle, WA 98101

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS

Weyerhaeuser Company - Corporate Headquarters
2525 South 236th
Federal Way, WA 98003

12. REPORT DATE

May 1982

13. NUMBER OF PAGES

388

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

US Army Corps of Engineers, Seattle District
P.O. Box C-3755/4735 E. Marginal Way South
Seattle, WA 98124

15. SECURITY CLASS. (of this report)

Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Volume II: Appendices A-Q
Volume III: Appendices R-T

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DUPONT	ENVIRONMENTAL IMPACT STATEMENTS	EXPORTS
NISQUALLY REACH	SHIPPING	
PUGET SOUND	DOCKS	
WASHINGTON (STATE)	FACILITIES	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Weyerhaeuser Company proposes to construct and operate a 250-acre export facility within the City of DuPont to ship forest products from manufacturing and wood operations in Western Washington to offshore markets. In 1976, Weyerhaeuser purchased a 3,200-acre site for this purpose. The E. I. DuPont de Nemours and Company used this site for the manufacture and ocean shipping of commercial explosives since 1909. (→ over)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

cont

Construction and operation of the proposed export facility would have a variety of adverse and beneficial impacts. In general, impacts on the physical environment would be adverse, whereas impacts on the socioeconomic environment would be both beneficial and adverse. Many adverse impacts would be mitigated. Volume I contains the environmental analysis of the impact of the proposed export facility.

Final Environmental Impact Statement

WEYERHAEUSER EXPORT FACILITY
AT DUPONT

VOLUME I

SEATTLE DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

1982

Summary

( ) Draft ( ) Revised Draft (X) Final Environmental Impact Statement

Responsible Office: Colonel Norman C. Hintz, District Engineer
U.S. Army Engineer District, Seattle
Post Office Box C-3755
Seattle, Washington 98124

Applicant: Weyerhaeuser Company, Number 071-OYB-1-005087, Corps of Engineers Permit Application

1. NAME OF ACTION: (X) Administrative ( ) Legislative

2. DESCRIPTION OF THE ACTION

The Weyerhaeuser Company proposes to construct and operate a 250-acre export facility at DuPont, Washington, to provide a central location for receiving products from company manufacturing and woods operations in Western Washington, and for rapid loading of these forest products into ocean going vessels. The proposed project includes replacement of the existing dock with a larger dock; loading equipment; a terminal area for receiving, handling and storage of forest products; the necessary supporting road access from the interstate system; rail access; a marshalling area for finished products and logs; a debarker; and a materials handling system to move products to the dock. The project is intended to enhance shipment of manufactured forest products. As world markets are developed for manufactured forest products, these would become the predominant products handled by the export facility. In the interim, export of logs from the proposed facility would predominate.

3. ENVIRONMENTAL IMPACTS

a. Introduction

Construction and operation of the proposed export facility would have a variety of adverse and beneficial impacts. In general, impacts on the physical environment would be adverse, whereas impacts on the socioeconomic environment would be both beneficial and adverse. Many adverse impacts would be mitigated. The numbers in parentheses at the end of each paragraph refer to Chapters/Sections in the EIS that contain a more detailed discussion of each impact.

b. Operation-Related Impacts

Following impacts would be expected from operation of the proposed export facility.

- o The proposed dock location is within the "urban" designation and is, therefore, consistent with the DuPont Shoreline Master Plan. The alternative dock would be located on property annexed from Pierce County to Dupont. This location would require a change in the City of Dupont's Shoreline Master Plan from Pierce County's designation of conservancy to urban. The zoning of the upland adjoining parcel was changed from general use to industrial when annexed by the City. The remaining portions of the facility would be consistent with the existing DuPont zoning designation (3.2.2).

- o Natural gravel deposits would be covered, making them less available as a usable resource (4.1.4).

- o Continued erosion along the path from the longshore parking lot to the dock would be expected (4.1.5).

- o Increased air emissions from vehicles, equipment, trains and ships would be minimal; operational levels would be within Washington State and Puget Sound Air Pollution Control Agency standards (4.3).

- o With hardsurfacing of permeable soils, stormwater runoff and groundwater recharge patterns would be changed (4.5.1).

- o The proposed reinforced-earth road down the Sequalitchew Creek Ravine would slightly alter subsurface water movement (4.5.1).

- o Contamination of groundwater from pollutants on the hard surfaced terminal area and roads would occur. Drinking water supplies would not be affected (4.5.2).

- o There would be minor alteration of currents and sediment transport around the immediate vicinity of the new dock because of the placement of pilings (4.5.3).

- o Due to the presence of ships and runoff from the dock and dock access road, increased concentrations of toxic materials (copper, zinc, tributyl tin, lead, cadmium, petroleum products) in water near the dock would be expected; however, concentrations would be low and no significant impacts on aquatic resources would be expected (4.5.4).

- o A major impact of the project on site terrestrial biology would be the elimination of 169 acres of vegetation and associated wildlife (4.6).

- Impacts on Nisqually Delta biological habitat, considered unique and regionally significant, would be minor unless an oil spill occurred, in which case, impacts could be significant (4.6.2).

- Larger populations of human-tolerant species, such as starlings, house sparrows, and mice could be expected in areas not affected by previous manufacturing activities. Populations of human-intolerant species would decline (4.6.3).

- The proposed reinforced earth road that would provide access to the dock from the terminal site would be raised above ground-surface level and would therefore block animal movement on the northside of the canyon. This barrier would reduce access by large mammals to the lower portion of Sequalitchew Creek, substantially reducing the value of that resource and adversely affecting the wildlife dependent upon it (4.6.5).

- Additional vehicular traffic on the site would increase animal road kills (4.6.5).

- Degradation of habitat quality for some species in Sequalitchew Creek Canyon would result from the dock access road (4.7.3).

- There would be a loss of a small area of open water currently used by tribal fishermen, a slightly increased potential of accidents involving DuPont-bound ships and fishing boats and gear, the proposed dock and shipping activities is not expected to result in interference with Nisqually Tribe fishing activities to the extent that the project would impair the tribe's ability to satisfy their moderate living needs (4.8).

- Subtidal (below the extreme low water line) habitat would be affected by increased shading provided by the larger dock. Dock piling communities would ultimately increase, since a greater number of piles are associated with the proposed dock (4.8.4, 4.8.5, 4.8.6.1).

- Anadromous and marine fish communities are not expected to be significantly affected. No major interference with migration behavior, spawning areas, or food organisms would be expected due to normal operations of the facility (4.8.6.1).

- There would be a low, but finite chance of a ship-related accident resulting in spillage of a moderate to large amount of oil. Under certain weather and tidal conditions, this oil could impact the Nisqually Delta causing serious ecological disruption for a period lasting from several months to several years (4.8.9, 4.11).

- Dock operations would significantly increase nighttime noise levels on the southeastern Anderson Island shoreline, at residences along this shoreline, in Nisqually Reach, and in the Nisqually Wildlife Refuge (4.9).

- Increased train traffic would result in more frequent train-whistle noise reaching the Village of DuPont (4.9).

- Lighting from the dock area and access road would be visible to viewers on Puget Sound, in DuPont, in the Nisqually Delta and I-5 (4.10).

- The frequency of a Weyerhaeuser freighter traffic-related oil spill in southern Puget Sound greater than 2.4 barrels has been calculated at one such spill in 103 to 325 years, depending on the number of port calls (4.11).

- The potential for ship wake impacts on shorebluff erosion, flooding or structural damage, and fish stranding would be low (4.11).

- Increased annual oil spillage risk from all sources associated with the proposed export facility would be insignificant, representing approximately 0.1 percent of existing risk in southern Puget Sound (4.11).

- The addition of Weyerhaeuser ships to existing traffic in southern Puget Sound would result in a potential increase of one casualty every 12 years (4.11.3).

- Because the increase in commercial vessel traffic would be relatively small (two to six percent) in southern Puget Sound, increased ship activity would not add significantly to existing collision hazards, swamping hazards, and hazards to small boats and fishing vessels in southern Puget Sound (4.11.3).

- The possibility of collision with commercial fishing boats and gear in Nisqually Reach by DuPont bound ships would be greater than in other sections of southern Puget Sound. The increased risk of collision for Nisqually Reach has not specifically been quantified (4.11.3).

- The proposed export facility would provide 47 to 91 new permanent jobs in the Puget Sound region (4.12.1).

- Up to 65 households would move into the immediate region because of the facility. Most workers would commute from their present residences (4.12.2).

- Transportation networks (road, water and rail), utilities constructed for the proposed project, and availability of adjoining property could encourage related forest-product industries to locate on this site over time. Environmental impacts, both direct and cumulative, associated with these industries cannot be assessed at this time (4.14).

- Three to eight trains would move onto the site a day. This increased traffic would delay vehicular traffic at crossings. Such delays would cause significant congestion if they occurred during peak traffic periods (4.14.3).

- Train traffic through the Village of DuPont would be eliminated (4.14.3).

- The only public facility or service that is not adequate to meet the small additional demands imposed by the proposed facility is the overcrowded classroom space in vicinity schools (4.15).

- Increases in the region's public utility loads and energy consumption would be within current capacities. Electrical power use at the facility would total 6.2 to 8.3 million kilowatt hours per year (compared to approximately 23,800 kilowatt hours per single family residence with electric heat). Annual fuel consumption by on-site equipment would total 500,000 to 600,000 gallons of diesel, 80,000 to 100,000 gallons of propane, and 4,000 to 5,000 gallons of gasoline (4.16.2).

- There would be an increase in DuPont's assessed valuation due to addition of the export facility (4.17.1).

- Increased public revenues from the export facility would be expected to exceed costs for providing services and facilities (4.17.3).

- The larger dock and piling-supported access road would be more visible from the Nisqually Reach and Anderson Island than the existing dock. The project would markedly alter the shoreline aesthetic values (4.19).

- There would be a possibility of disturbing presently unknown historic and archaeological sites where the facilities are to be located. No known cultural resources listed or eligible for inclusion in the National Register of Historic Places would be affected by the proposed project (4.20).

c. <u>Construction-Related Impacts</u>

- There would be grading of portions of 169 acres and excavation of 652,000 cubic yards of earth (4.1.1).

- Fossil fuels, building materials, water supplies and electrical power would be used to construct the facility (4.1.4).

- Increased erosion with consequent sedimentation in Sequalitchew Creek would occur during construction of the access road from the terminal site to the dock (4.1.5).

- Occasional violation of the 24-hour air-quality standard for suspended particulates could be expected during maximum construction activity. Violations would be expected on windy days and when background levels are high (4.3.3).

- Nearshore turbidity in Nisqually Reach would increase during removal of the existing wharf and driving of pilings for the new roadway and dock (4.5.4).

- Aquatic plants in Sequalitchew Creek would be affected by construction of the culvert where the access road crosses the creek (4.7.2).

- Increased turbidity from removal of the existing dock and pile driving for the new dock could have a short-term adverse impact on the small eelgrass bed south of the existing wharf and organisms dependent upon it (4.8.6.2).

- Organisms inhabiting old wharf pilings and those in the immediate vicinity of each new piling would be destroyed during construction of the dock (4.8.5).

- Marine fish populations that feed on wharf-piling organisms would be deprived of this food source. However, a new piling community would soon become established on the new pilings and would provide a new food source (4.8.6).

- During pile-driving, intermittent noise levels would be loud enough to interfere with outdoor speech on portions of Anderson Island (4.9).

- Seventy to 300 construction workers over a two-year period would be needed to build the facility (4.12.2).

- There would be an increase of traffic congestion and road wear during rush hours on existing roads during the construction period, but the increase would be within the roadway capacity (4.14).

- There would be minor short-term increases in regional income from construction spending (4.17).

- The state would receive about $1.7 million and the City of DuPont about $190,000 in state and local sales-tax revenues during construction of the facility (4.17.1).

d. Future Development

As explained in Appendix B, Weyerhaeuser normally considers a wide range of sites for any particular manufacturing facility that it decides to build. The 250-acre Weyerhaeuser-DuPont site undoubtedly would become a "candidate site" for projects that Weyerhaeuser may consider in Western Washington. This is true whether or not the export center is constructed.

Weyerhaeuser has stated that it presently has no other plans for the site. Any future development would require a complete, independent review by all applicable government agencies, based on the regulations and policies in effect at that time. Any further work in navigable waters of the United States would require a Corps of Engineers permit.

4. MITIGATING MEASURES COMMITTED TO BY WEYERHAEUSER COMPANY

a. Introduction

According to a letter contained in Appendix B regarding the development of the proposed project and any future projects, Weyerhaeuser has pledged that its planning, design, construction, and operations would include all appropriate measures to minimize and mitigate observed and reported environmental impacts on the site and nearby areas. Restrictions and standard operating procedures would be developed prior to construction and operation to minimize adverse environmental conditions, and any violations of local, state or Federal regulations would be immediately reported by Weyerhaeuser to the proper regulatory agency.

A proposed Memorandum of Understanding (MOU) between Weyerhaeuser and the U.S. Department of Interior, Fish and Wildlife Service (FWS) would restrict development in certain areas under Weyerhaeuser ownership at DuPont. For example: (1) the bluff south of Sequalitchew Creek and adjacent to Hoffman Hill would be maintained as open space (about 23 acres); (2) an approximately 47-acre scenic and wildlife management easement in Sequalitchew Creek Canyon would be granted to Washington State and managed by the Department of Game and Fisheries; and (3) the 49 acres of Oak Savannah vegetation type would be designated as a wildlife study area. Any future development would necessarily take these restrictions into account. An agreement signed May 29, 1981 by Weyerhaeuser Company, Washington State Department of Ecology (WDE) and the City of DuPont binds Weyerhaeuser to the provisions outlined in the MOU. Pending review of this EIS, FWS will sign the MOU.

Weyerhaeuser has stated that it would also employ the following measures to reduce environmental impacts resulting from project construction and operation. Numbers in parentheses following each measure indicate the text sections where the measure is discussed.

b. Earth

- Longshore path down the bluff will be improved and maintained to the extent the City of DuPont determines necessary to minimize erosion and improve access for firefighting personnel and equipment (4.1.7).

- Use of appropriate erosion control measures would reduce sediment movement during construction. The dock access road would be constructed in stages so that the amount of soil exposed at any one time would be minimized. Temporary diversions with sediment basins or filter screens would be used (4.1.5).

- Construction of the primary access road and railroad crossing of Sequalitchew Creek during low rainfall periods (June-September) would reduce potential erosion (4.1.5).

- The hazard of slope failure in construction of the dock access road would be reduced by avoiding steep cuts (4.1.5).

c. Air

- o During construction and dry periods, disturbed areas would be watered to control fugitive dust (4.3.3).

- o Construction vehicles would operate at reduced speeds on dry windy days to minimize fugitive dust (4.3.3).

d. Water

- o Minimizing groundwater withdrawal by recycling would avoid substantive decreases in Sequalitchew Creek flow (4.5.1).

- o During construction of the access road along Sequalitchew Creek, erosion controls would be used to reduce stream turbidity (4.5.2).

- o Monitoring of Sequalitchew Creek turbidity during construction and implementation of any necessary additional erosion controls would reduce turbidity and identify when additional measures are needed. Monitoring of ground and surface water quality during operation of the Creek will be in accordance with a plan satisfactory to the Department of Ecology; required steps would be taken to prevent continuation of any violation of water quality standards (4.5.2).

- o Construction access roads would be gravelled where necessary to minimize sediment runoff into Sequalitchew Creek or Nisqually Reach (4.5.3).

- o Appropriate measures would be taken to ensure that roadside ditches do not become clogged (4.5.2).

- o Water quality of selected wells, Sequalitchew Creek, and Nisqually Reach would be monitored according to a program satisfactory to the Washington Department of Ecology (WDE). Corrective steps would be taken to rectify any continued violations of state water quality standards (4.5.2, 4.5.4).

- o Lands around Old Fort Lake would never be used for manufacturing purposes (3.2, 4.5.2).

- o A request would be made to the City of DuPont that Edmond Marsh be designated "Conservancy" (3.2, 4.5.2).

- o Before shipping operations, Weyerhaeuser would prepare a contingency plan for control and cleanup of any oil spills (4.5.4, 4.11).

- o Provision of drainage under or through the reinforced earth road to the dock would minimize its potential interference with groundwater movement (4.5.3).

- o Storage of petroleum products or toxic materials on the dock would be avoided (4.5.4).

e. Terrestrial Biology

- o Finalization of the Weyerhaeuser - FWS Memorandum of Understanding (MOU) that would limit development of certain sensitive areas of the site would reduce habitat loss and disturbances to wildlife on the DuPont site and portions of the Nisqually Wildlife Refuge (3.2).

- o Denuded portions of construction corridors would be stabilized during construction, then replanted (4.6.1).

f. Freshwater Biology

- o Construction of the road across Sequalitchew Creek would occur between June and September, thereby minimizing turbidity during the lowest creek flow period (4.7.2).

- o Only selective logging would be performed in certain areas (3.2, 4.7.3).

- o According to the Weyerhaeuser - FWS MOU, an easement would be granted to the State of Washington to protect wildlife habitat in Sequalitchew Creek Canyon (3.2, 4.7.3).

- o According to the Weyerhaeuser - FWS MOU, uses of Sequalitchew Creek Canyon would be limited to recreational and research uses (3.2, 4.7.3).

g. Marine Biology

- o Weyerhaeuser would coordinate with the Nisqually Indian Tribe to determine the likely effects of the export facility on Nisqually Tribe fishing activities and to seek agreement on measures to mitigate any anticipated impairment of their treaty fishing rights (4.8.11).

- o The construction season for the dock and access ramp would be determined in conjunction with the Department of Fisheries to avoid impacts on salmon out-migration (4.8.11).

h. Noise

- o Plans and details for berms and vegetation to screen the Village of DuPont from noise of the access road and rail spur would be submitted to the City of DuPont for their review and comment (4.9).

- o Unless specifically approved by the City of DuPont, no pile driving or other noisy construction work would be conducted in the nighttime hours from 10:00 P.M. to 7:00 A.M. at the dock, within 500 feet of the Nisqually Reach, or within 1,500 feet of any residence (4.9).

- o Weyerhaeuser would be obligated to take all reasonable steps requested by the City of DuPont to operate the facility in ways which would minimize noise impacts on the City's existing residential area, Anderson Island, and the Nisqually Wildlife Refuge (4.9).

i. Light and Glare

- o Weyerhaeuser would coordinate with Washington State Department of Fisheries to develop an acceptable dock light design that would minimize interference of fish movements. Lighting design plans would be reviewed with City of DuPont and Department of Fisheries (4.10).
- o Berms and evergreen plantings would be used to screen the Village of DuPont from light and glare (4.10).
- o Weyerhaeuser would take all reasonable steps to operate the facility in ways which would minimize light and glare on the City's existing residential area, Anderson Island, and the Nisqually Wildlife Refuge. Lighting levels of the dock and access ramp would be reduced between loading operations, but not below levels necessary to maintain security and safety (4.10).

j. Risk

- o Weyerhaeuser would follow the National Fire Protection Association Guidelines (NFPA 46 and 46B), or other fire protection procedures approved by the City of DuPont, and would periodically review with the City of DuPont its plans for prevention and suppression of fires (4.11, 4.15).
- o Plans for control and clean-up of any spills of oil or environmentally hazardous materials in connection with construction and operation of the facility, including equipment and training of personnel would be approved by the City of DuPont prior to construction for the construction spill plan and prior to first shipment for the operations spill plan. Plans would be submitted for review to the City of DuPont, Coast Guard, EPA, USFWS, and the Corps of Engineers (4.11).

k. Transportation/Circulation

- o The access road used during construction would be inspected regularly and repaired as needed (4.14.1).
- o Weyerhaeuser would reimburse the City for any costs reasonably incurred for control of construction traffic along the DuPont/Steilacoom Road and any other public roads within the City of DuPont (4.14.1).

- Work schedule and plans including those for traffic patterns, routing and loads would be reviewed and approved by the City of DuPont. Construction access would be routed away from the village as much as possible. Unless specifically approved, no heavy trucks or construction traffic would use Barksdale Avenue, Louviers Avenue, Brandywine Avenue or DuPont Avenue (4.14.5).

l. Public Services

- Weyerhaeuser would maintain cattle on the property to graze in the grasslands, thereby reducing fire hazards (4.15.1).

- Weyerhaeuser would cooperate with the City of DuPont in development of plans for public recreation as part of the City's comprehensive planning process. Until completion and implementation of such a public recreation plan by the City, Weyerhaeuser would allow public recreational use of (1) its tidelands, and (2) the longshoremen's trail to the beach (including the tunnel under the BN railroad tracks), the parking area associated with the trail, and the access road to the parking area (4.15.1).

m. Governmental Finance

- Weyerhaeuser would continue to pay the City of DuPont $48,000 per year to defray the costs of increased fire and police protection and miscellaneous administrative costs until such time that the revenues associated with the project would exceed the local costs (4.17.1).

n. Aesthetics

- Plans and details for berms, evergreen plantings or other means to screen the village of DuPont from visual impacts of the access road and rail spur would be submitted to the City of DuPont (4.19.1).

- Maintaining buffers and distance from public roads and residences whenever possible would minimize adverse visual impacts (4.19).

o. Cultural Resources

- All contracts for construction work that could disturb any known or unknown archaeological sites would contain clauses requiring the contractor to participate in briefing and training sessions approved by the Washington State Historic Preservation Officer (SHPO), to immediately stop work and notify SHPO and Weyerhaeuser if any archaeological sites are discovered, and to suspend all work in the area of such sites until completion of consultation with the SHPO (4.20.1).

- All contractors would be briefed before commencement of work on the location of all known and suspected archaeological sites. The SHPO and the Nisqually Indian Tribe would be invited to participate in these briefings (4.20.1).

- o If any archaeological sites were discovered, Weyerhaeuser would consult with the SHPO and the Nisqually Indian Tribe about the most appropriate measures to record, recover, and preserve the sites (4.20.1).

- o Where practical, the project would be redesigned or relocated to avoid disturbance to any significant sites discovered during construction (4.20.1).

- o Auger tests along part of the main access corridor and on both sides of Sequalitchew Creek where excavation would occur would minimize risks to any presently undiscovered archaeological resources (4.20.1).

- o Test pits (2 m x 2 m) would be excavated at the railroad dump sites and any artifactual material recovered would be carefully analyzed and compared with historical data that relates to that period of industrialization (4.20.1).

- o If the location of the Richmond Mission site were found to be within the final bounds of the project, testing would be undertaken (4.20.1).

5. UNAVOIDABLE ADVERSE IMPACTS

There are several unavoidable adverse impacts of the proposal. The more significant of these are:

- o Elimination of 169 acres of wildlife habitat in the project upland area.

- o Elimination of three acres of wildlife habitat in Sequalitchew Creek Canyon and degradation of the remaining 37 acres.

- o Formation of a barrier to animal movement in the ravine.

- o Increased human activity and noise along the DuPont shoreline. Weyerhaeuser has committed to operate the facility in a manner that would minimize noise impacts and in no case to exceed W.A.C. noise regulations.

- o Lowered aesthetic value of the shoreline.

- o Increased navigational risks of vessel casualties, oil spills, and damage to recreational boats and commercial-fishing vessels.

- o An increase in the possibility of a major disruption to the Nisqually Delta ecosystem in the event of a major oil spill.

- o Interference with Nisqually tribal fishing activities.

Other unavoidable adverse impacts include:

- Increased turbidity along the DuPont shoreline during removal of the wharf and construction of the new dock including possible disturbances to the intertidal and subtidal areas of Nisqually Reach.
- Occasional on-site violation of 24-hour suspended-particulate local standards during construction.
- Slightly increased emissions of air pollutants from vehicles and equipment (levels of pollutants would remain well within applicable standards).
- Increased light and glare along the shoreline.
- A small reduction in regional longshore employment from the advanced cargo-handling system.
- Consumption of mineral resources and energy.
- Destruction of sessile benthic organisms where pilings would be driven.
- Increased plankton mortality near ships from discharge of engine cooling water.
- Low levels of hydrocarbons and heavy metals in treated stormwater runoff and from the dock and access road would enter Nisqually Reach. Bioaccumulation of some of these contaminants would occur in marine organisms.

6. ALTERNATIVES TO THE PROPOSED ACTION

The Corps of Engineers has three options. First, the Corps may deny the Section 10 permit required for development of the proposed export facility. Construction of the proposed dock would be prohibited by this action. Second, the Corps may issue the permit with standard conditions. Third, the permit may be issued with special conditions that would mitigate many anticipated adverse impacts.

Project alternatives considered by Weyerhaeuser during the development of plans for the proposed facility included alternative sites, alternative site access, alternative facility designs and the "no action" alternative.

Twenty-nine sites in Washington were screened by Weyerhaeuser against selected site requirements. In addition to the DuPont site, the screening process led to detailed scrutiny by Weyerhaeuser of a site west of the Nisqually Delta in the Hawks Prairie area, a site near Chenault Beach in Snohomish County, and the Port of Tacoma. Of these sites, DuPont most closely met Weyerhaeuser's site requirements. Development of Port of Tacoma lands would be associated with the fewest adverse environmental impacts;

however, the Port of Tacoma only marginally meets draft shipping requirements of the project and the Port does not have a 200 acre parcel of land available for sale to Weyerhaeuser. Of the remaining sites considered for development, impacts on the natural environment would be greatest if the proposed export facility were located at either DuPont or Hawks Prairie. Although some marine resources and upland habitat would be lost at Chenault Beach, overall impacts would be less than at DuPont or Hawks Prairie, which are located adjacent to the Nisqually Delta. Also, loss of a portion of Sequalitchew Creek Canyon habitat at DuPont would be a significant loss of wildlife habitat.

Constraints of the Chenault Beach and Hawks Prairie sites are associated with the proximity of existing and prospective residential areas to the site. Increased noise levels would affect these residences to an undetermined degree. Locating the export facility at DuPont would probably have the least effect on residential areas. Socioeconomic impacts would be essentially equivalent for all four sites.

Existing Weyerhaeuser facilities at the Port of Tacoma, Grays Harbor, Willapa Bay, Everett, and Longview are inadequate for the proposed export facility mainly because of insufficient available acreage and insufficient drafts. In addition, analysis of Puget Sound area public port districts indicates that none of these satisfies all the mandatory site requirements for the proposed action.

Preliminary planning studies at the DuPont site by a consultant to Weyerhaeuser identified three potential industrial areas. The northern area was selected as the most favorable for the proposed facility based on environmental compatibility, physical characteristics, land ownership, access, and operability of the facility. Eight primary road access alternatives and eight rail access alternatives were evaluated in cooperation with the five groups having jurisdiction or ownership of land that would be directly affected. Environmental factors evaluated included archaeology/history, topography, soils/geology, traffic, aesthetics, noise, land use and flora/ fauna. The evaluation showed that use of rail or road alternatives would create more adverse impacts than the selected access routes.

Six conceptual designs for the proposed export facility were evaluated by Weyerhaeuser; many elements of these were incorporated into the design of the proposed project. The aspects of the design having the greatest variation in potential environmental impacts are (1) the system used to transport cargo from the terminal area to the dock, and (2) the dock itself. Alternative transport systems would avoid Sequalitchew Creek canyon by using tunnels, elevated railways or partially buried guideways that would go directly down the bluff. These systems would avoid the adverse impacts caused by a road through the canyon but would create a different set of adverse impacts related to disturbance of the bluff. All but one of the dock alternatives call for some type of dock and therefore have potential impacts similar to those of the proposed dock; the alternative that avoids these impacts would require extensive excavation of the bluff and dredging of 1.5 acres. The various alternative systems designed, which include a bluff transport system, would avoid only the potential alteration of groundwater recharge, and most would have additional adverse impacts.

If the Corps of Engineers' Section 10 Permit is not issued to Weyerhaeuser, three possible fates for the DuPont site have been evaluated in Chapter 6 in general terms. First, purchase of the site to preserve it as open space and wildlife habitat would avoid most environmental impacts attributed to the project. Second, alternative industrial development of the site would avoid most impacts associated with marine resources but would result in a different set of impacts on upland and freshwater areas. Third, residential development would avoid some shipping related impacts; however, other impacts, especially on upland flora and fauna, could be more severe.

7. COORDINATION WITH OTHERS

Development of this National Environmental Policy Act Environmental Impact Statement (NEPA EIS) has involved coordination with Federal, state, and local governmental agencies, interest groups, and individual members of the public. Comments on the proposed project have been received by the Seattle District Corps of Engineers in response to four public notices (dated 31 August 1978, 1 July 1979, 4 September 1979, and 23 January 1981), a public workshop (12 September 1979), and the draft EIS (issued 29 July 1979). Complete lists of participants in the NEPA EIS process are presented in Chapter 9. Transcripts of the public workshop have been published in Volume II of Appendices as Appendix R. Comment letters on the public notices and the draft EIS are also contained in Volume II of Appendices as Appendix S and Appendix T, respectively.

8. EIS FILING

The NEPA draft EIS was filed with the U.S. Environmental Protection Agency on 29 July 1979.

The NEPA final EIS was filed with the U.S. Environmental Protection Agency on 28 MAY 1982.

Table of Contents

Page

VOLUME II

APPENDICES - CONTENTS

VOLUME III

APPENDICES - CONTENTS

List of Figures

List of Tables

List of Preparers

The following people were responsible for preparing
the Environmental Impact Statement

Name	Expertise Applied to the EIS	Experience	Professional Discipline
Corps of Engineers			
Steven Dice	Environmental Planning (Supervise preparation of Corps EIS)	9 years, environ. resource supervisor, Corps, Seattle District; 3 years, planning policy, Corps of Engineers, Office of Chief of Engineers.	Ecology
Fred Weinman	Environmental Planning (Review)	8 years, environmental planner and biologist, Corps of Engineers, 4 years estuarine ecology at University of Washington.	Estuarine Ecology
Stephen Martin	Environmental Planning	6 years, biologist, Corps of Engineers; 2 years invertebrate aquaculture, 2 years biological baseline studies, Puerto Rico Nuclear Center, U.S. Atomic Energy Commission.	Fisheries Biology
URS Company			
Steve Fusco	Project Manager, Land Use, Aesthetics, Demography	7 years, environmental planner, URS Company; 2 years land use planning.	Urban Planning
Paul Korsmo	Assistant Project Manager, Terrestrial Biology	3 years, terrestrial biology, URS Company; 8 years biology teaching.	Biology

Name	Expertise Applied to the EIS	Experience	Professional Discipline
Sylvia Burges	Freshwater Quality	4 years, environmental assessment and water resource planning, 1 year, water quality assessment.	Water Quality
Grant Bailey	Manager of the Baseline Studies' Quality Assurance Program	6 years, marine biology, oceanography, URS Company; 4 years marine environmental studies, other consultants.	Biology
Karl Leaverton	Socioeconomics	3 years, socioeconomic impact assessments, URS Company	Socioeconomics
Mike Miller	Air Quality	3 years air quality studies and assessments, URS Company.	Mechanical Engineering
Phillip Dibner	Terrestrial Biology	4 years, terrestrial biology studies, URS Company.	Biology
Barbara Westree	Marine Biology and Oil Spill Effects	7 years, marine biology baseline studies and assessments, URS Company.	Biology
William Van Horn	Navigational Risk	16 years, navigational risk and civil defense, URS Company.	Engineering
Jack Jenkins	Air Quality	4 years, air quality studies, URS Company.	Mechanical Engineering
C. Thomas Williams	Terrestrial Biology	4 years, terrestrial biology, URS Company; 4 years biology, other consultants.	Biology
Stephen Plake	Socioeconomics	3 years, socioeconomic studies, URS Company.	Economics
Leon Crain	Noise	5 years, noise assessments, URS Company.	Mechanical Engineering
Dave Hamlin	Transportation	5 years, transporation and traffic engineering for municipalities.	Civil Engineering

Name	Expertise Applied to the EIS	Experience	Professional Discipline
Dale Anderson	Aquatic Biology	6 years, aquatic biology, URS Company.	Environmental Science
Donald Sanders	Geology	4 years, geological assessment, URS Company.	Geology
Charles Tang	Computer Modeling for Oil Spills	6 years, computer modeling, URS Company.	Computer Modeling

The following organizations and individuals were responsible for preparing baseline studies for this Environmental Impact Statement

Organization	Individual(s) Responsible	Baseline Study
CH_2M Hill		Marine Hydrology
Mathematical-Sciences Northwest	J. Storie	Fuel Spill Modeling
Oceanographic Institute of Washington	J. Pizzo	
The Evergreen State College	R. Wisseman, S. Cook, M. LaGory, T. Pearce, P. Searles	Intertidal Studies
The Evergreen State College	S. Klotz, S. Madsen, P. Miller, D. Smith	Nisqually Delta Terrestrial Biology
Dames & Moore	M. Athey, J. Houghton, M. Kyte	Subtidal Studies
U.W. Fisheries Institute	K. Fresh, D. Rabin, C. Simenstad, E. Salo, K. Garrison, L. Matheson	Salmonid Resources
Weyerhaeuser	R. Thut	Marine Water Quality
Weyerhaeuser	R. Thut	Freshwater Ecology
Weyerhaeuser	C. Ward	Atmospheric Dispersion Modeling and Aerometric Studies
Weyerhaeuser	D. Crawford	Noise
Weyerhaeuser	S. Duncan	Soils and Geology

Organization	Individual(s) Responsible	Baseline Study
Weyerhaeuser	R. Thut, B. Firth, S. Vincent, P. McGreer, T. Friberg	DuPont Terrestrial Ecology
National Heritage	A. Onat, L. Bennett, T. Riordan, D. Stratton, G. Lindeman	Archaeological/ Historical Studies
URS Company	S. Plake	Socioeconomic Studies
URS Company	L. Crain	Noise Modeling Studies
	Dennis Martin	Biological Assessment/ Bald Eagle
	Rufus Kiser	Biological Assessment/ *Aster Curtus*
Towne, Richards and Chaudiere, Inc.	Jan Hauge	Supplementary Noise Modeling Studies

Disclosure Statement

URS has prepared the major input to the Seattle District Corps of Engineers Environmental Impact Statement for the permit application Seattle District Number 071-OYB-1-005087 submitted by Weyerhaeuser Company for the proposed DuPont Export Facility.

We certify that we have prepared this input in conformance with guidance and participation of the Corps of Engineers in the role of an independent third party contractor. Weyerhaeuser Company provided information only on project description and alternatives with URS independently developing impact assessment.

We further certify that URS has no financial or other interest in the outcome of this project.

Jeffrey J. Yarne

Jeff Yarne, P.E.
Vice President

1.0 Project Description

1.1 AUTHORITY

The U.S. Army Corps of Engineers is responsible for regulating work in all navigable waterways of the United States under the authority of Section 10 of the Rivers and Harbors Act of 3 March 1899 (30 Stat. 1151; 33 U.S.C. 403).

Weyerhaeuser Company has applied to the Seattle District, Corps of Engineers for a Section 10 permit (#071-OYB-1-005087) to construct a dock for berthing and loading ships with forest products in the Nisqually Reach, Puget Sound, at DuPont, Washington. The revised public notice announcing the permit application (January 23, 1981) and previous notices July 1, 1979, September 4, 1979, and August 31, 1978 constitute Appendix A. The action does not come under the purview of Section 404 of the Clean Water Act.

The nature and impacts of the work proposed and the public response generated from the public notices has necessitated the preparation and coordination of this environmental impact statement (EIS) as required by Section 102(2)(c) of the National Environmental Policy Act (NEPA).

On April 27, 1978, Seattle District Corps determined that a federal EIS would be prepared prior to any decision to issue or deny a permit to Weyerhaeuser Company. The final decision would be based, in part, on information contained in the final EIS (FEIS).

1.1.1 JURISDICTION

The Corps of Engineers' permit jurisdiction in the proposed area of development is confined to those areas waterward of mean high water (MHW) and to adjacent wetlands extending landward of that line. However, the Corps considers the total project including the upland portions to be a single proposal for which the environmental impacts are assessed.

1.1.1.1 INTRODUCTION /

Weyerhaeuser Company proposes to construct and operate a 250-acre export facility within the City of DuPont to ship forest products from manufacturing and wood operations in Western Washington to offshore markets. In 1976, Weyerhaeuser purchased a 3,200-acre site for this purpose. The E. I. duPont de Nemours and Company used this site for the manufacture and ocean shipping of commercial explosives since 1909.

Information received from E.I. duPont de Nemours and Company has led to the following description of plant operations (Joslin, 1980). Although these facilities physically covered only about 10 percent of the area of the site, the operations were spread over approximately 50 percent of the site. Federal and state laws required the separation of facilities and called for buffered areas. Therefore, natural vegetation was maintained between the Company's facilities, which were connected by roads and narrow gauge rails.

Traffic between the various manufacturing and storage areas involved transportation by truck, narrow gauge rail, and cable car. Raw materials were transported from warehouses to manufacturing areas by both truck and by narrow gauge railway. From manufacturing areas, semi-finished products were carried by cable car, truck, and rail to other manufacturing areas continually two shifts per day. During ship loading, the narrow gauge railway transported finished products from the magazines to the wharf, amounting to about four days of continuous operation per month. Finally, maintenance and service trucks operated all over the plant during day and night shifts.

In addition, rail traffic to the site involved one trip per day. Trucks, on the other hand, made trips to and from the site ten times per day. The port call frequency by ships up to 615 feet (187 meters) long at the DuPont wharf was 29 port calls per year during the 1960's and 1970's, an average of 2 1/2 port calls per month.

The DuPont operations included land and water oil shipment, transfer operations, and storage. The DuPont oil storage tanks are still present in Sequalitchew Creek Canyon, as are the pipelines that crossed under the creek to upland boilers. Oil was offloaded at the existing dock from oil barges and was transported by pipeline to the storage tanks until used.

Explosives testing occured at three different areas on the site--the bluff area approximately one-half mile south of Sequalitchew Creek, an area about 600 feet south of Sequalitchew Creek and one-half mile southeast of its mouth, and an area north of the Creek near the start of the proposed Weyerhaeuser dock access road. The frequency and number of tests varied from zero to several tests per day.

A typical number of employees at the DuPont plant during times of moderate production volume was about 185 people including managerial and supervisory personnel.

Most of the 3,200-acre site is upland. Weyerhaeuser owns none of the waterfront land or tidelands south of Section 22 (2,400 feet south of the DuPont wharf). The mainline tracks of the Burlington Northern Railroad separate the upland site from the beach and tidal areas. The only access to the beach from the site is through a tunnel under the BN railroad tracks for the narrow gauge railroad. Weyerhaeuser retains an easement from BN to cross their lands to gain access to the water.

Two hundred seventy (270) acres of the site are leased to Fort Lewis (as of 1 May 81) as a sanitary landfill and rifle range.

Recent aerial photographs of parts of the site, showing the proposed Weyerhaeuser facility location as well as the old DuPont Company manufacturing area, are presented in Figures 1, 2, and 3.

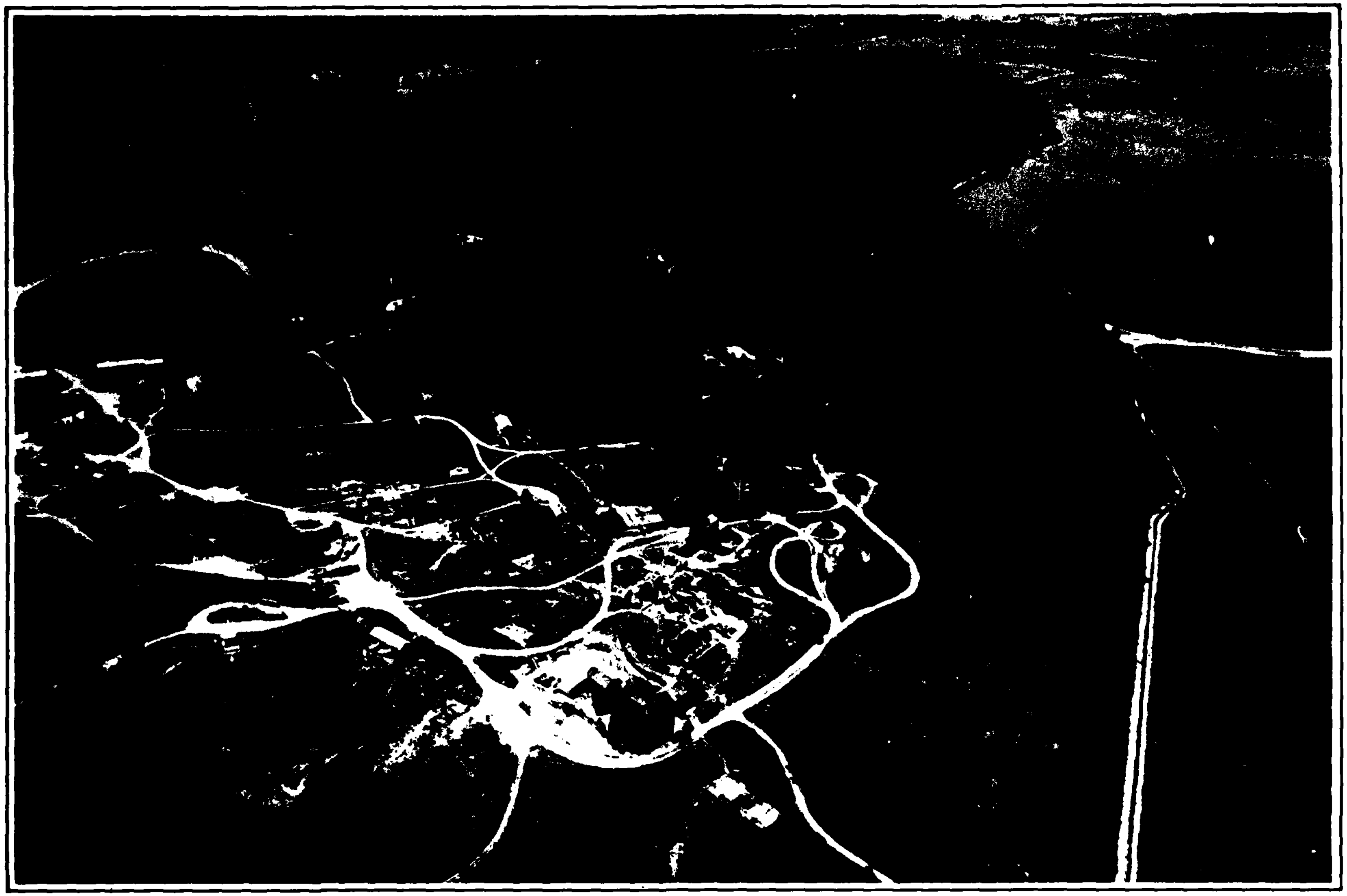
Before Weyerhaeuser purchased the DuPont site, the company investigated other Puget Sound sites, seeking a location central to both its manufacturing facilities and timberlands in Washington State. This central location would allow the company to consolidate some existing trade and develop new markets for expanded trade in manufactured products. A central location allows the most cost-effective solution from a land transportation perspective. These sites, the selection process by which a site was selected as the most suitable for the export facility, and the importance of an export facility being central to Weyerhaeuser's manufacturing centers and resources are described in Chapter 6.

Weyerhaeuser prepared a statement to justify the need for the type of export facility that they are proposing at DuPont. Their report is included as Appendix B of this FEIS. Basically, Weyerhaeuser believes that their future success in the forest product industry beyond the year 2000 depends on efficient deep harbor export facilities in the Pacific Northwest. Weyerhaeuser forest land holdings are large enough to allow them to produce raw materials at least at a stable rate until 2000. Due to the Company's tree farming programs, they would be able to increase the rate of production following the year 2000 if domestic and foreign market demands increased (see Appendix B for further discussion).

They have indicated that their traditional domestic markets are currently declining and the most successful forest product companies will be the ones who can most efficiently serve the Far East and European markets. A deep harbor is needed to allow flexibility to bring large ships, yet to be designed, to the export facility. Generally, the larger the ship, the more cost-effective per ton for moving cargo. Presently, smaller ships than those anticipated for the future load at several Weyerhaeuser docks in Washington (Everett, Aberdeen, Tacoma, and Longview). These docks would continue to be used but Weyerhaeuser would rely on the proposed export facility to increase its export volumes, particularly of finished products. Loading larger ships quickly at one dock is more efficient than using small vessels. Because of draft constraints and limitations caused by bridges, Weyerhaeuser uses a combination of small vessels (less than 40,000 DWT) and multi-stop loading of mid-sized vessels. Because of the inefficiencies of multi-stop loading, these mid-sized ships are actually underway moving cargo only about 50 percent of the time. With the one stop major export facility, it is anticipated this would be 90 percent of the time, getting cargo to customers faster and more efficiently.

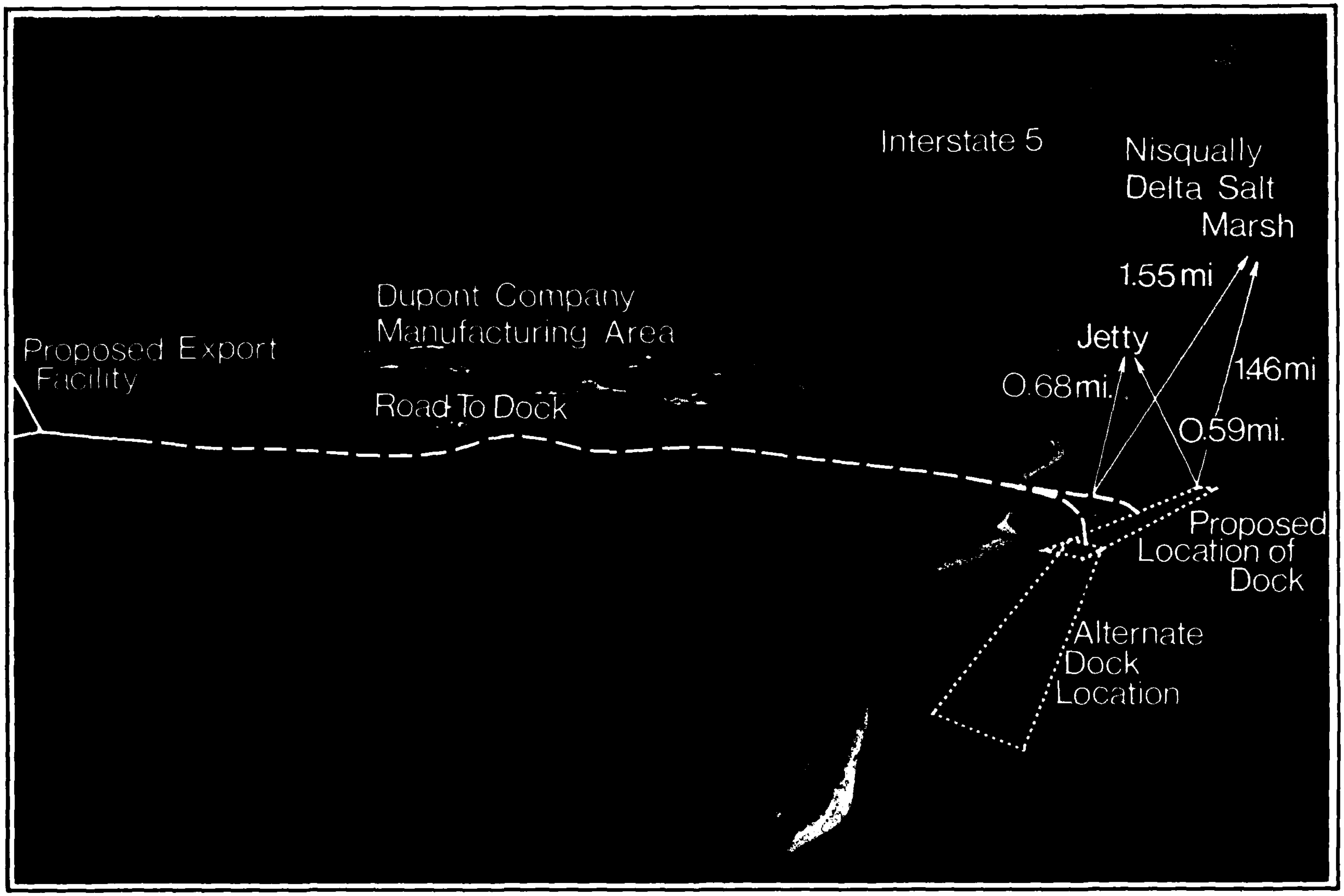
The DuPont site, which lies near the geographic center of Weyerhaeuser's Western Washington operations, was selected late in 1975, its purchase by Weyerhaeuser was announced in January 1976.

William L. Pereira and Associates were retained to develop plans for where the export center should be on the site, and where access roads and railroads to the site should be located. Pereira and Associates sought to



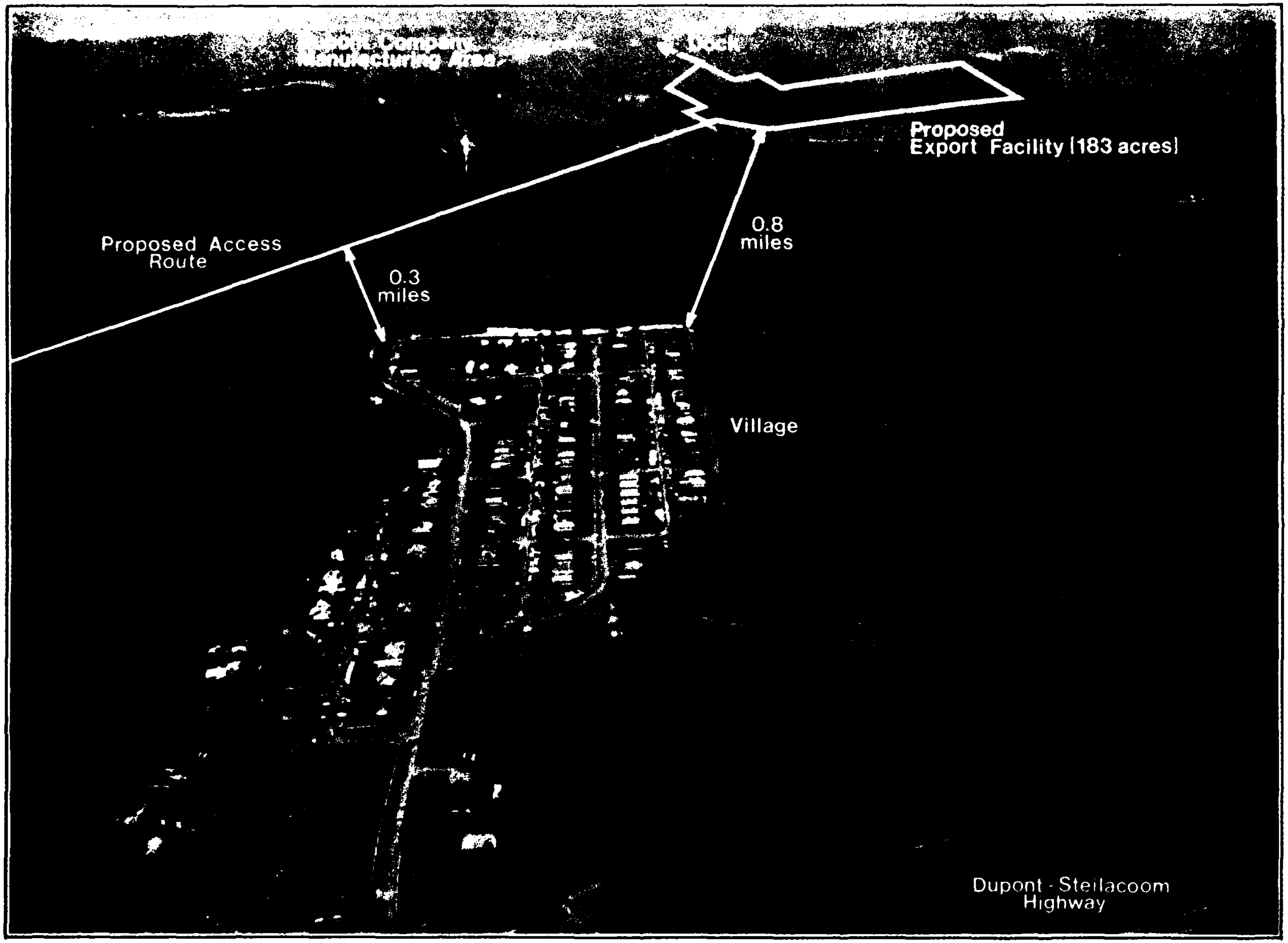
North

FIGURE 1
AERIAL VIEW OF DUPONT
COMPANY MANUFACTURING
AREA
June 1977



North

FIGURE 2
AERIAL VIEW OF PROPOSED
EXPORT FACILITY PLACEMENT
FROM SHORELINE
June 1977



North

FIGURE 3
AERIAL VIEW OF PROPOSED
EXPORT FACILITY PLACEMENT
FROM VILLAGE OF DUPONT
June 1977

optimize the location of the export center on the site so as not to foreclose future options. In this planning process, environmental considerations were used to determine the best general locations for facilities. Pereira's planning activities for the DuPont site are discussed in more detail in Chapter 6, Alternatives to the Proposed Action.

Weyerhaeuser held a DuPont Export Facility design competition among four major international port designers. They were instructed to present plans for the most efficient and environmentally sensitive marshaling yard, dock access, and dock. Weyerhaeuser selected Jaakko Poyry of Finland and incorporated the majority of ideas from their plan. They also incorported ideas from the other competitors and added their own considerations to develop the proposed facility design.

The existing dock, road, and rail access to the site would be rebuilt or replaced. Weyerhaeuser proposes to use approximately 250 acres for the export facility. The proposed project includes a new dock and loading equipment, a marshaling area for forest products, a log debarker, a materials-handling system to move products to the dock, a terminal area for receiving, handling, and storing finished products and logs, road access from the interstate system, and rail access.

1.2 LOCATION

The proposed facility would be located within the City of DuPont. As shown in Figure 4, DuPont is situated near the western boundary of Pierce County, midway between the Cities of Tacoma (Pierce County) and Olympia (Thurston County).

The City of DuPont is bounded by privately owned land, Puget Sound, Interstate 5, and the Fort Lewis Military Reservation (Figure 5). Except for small, unincorporated areas on the northwestern and southwestern corners of its boundary, DuPont is entirely bordered by the Fort Lewis Military Reservation and Puget Sound.

The Weyerhaeuser property is bounded on the west by Burlington-Northern Railroad ownership. The City of DuPont is bounded on the west side by the mid-channel of Nisqually Reach and private property.

The closest City to DuPont is Steilacoom, which is separated from DuPont by Fort Lewis. Interstate 5 links DuPont with the two major urban areas within the immediate vicinity--the Lakewood area, a large unincorporated residential area six miles to the northeast, and the City of Lacey, approximately ten miles southeast, on the outskirts of Olympia.

The Village of DuPont originated in 1906 when the E. I. duPont de Nemours and Company purchased approximately 1,000 acres from a private estate to house its construction workers. This housing area grew into a community of permanent homes as the explosives plant grew.

In 1951, the duPont Company replatted the village and sold the existing houses to its employees. Immediately afterwards, the residents voted to

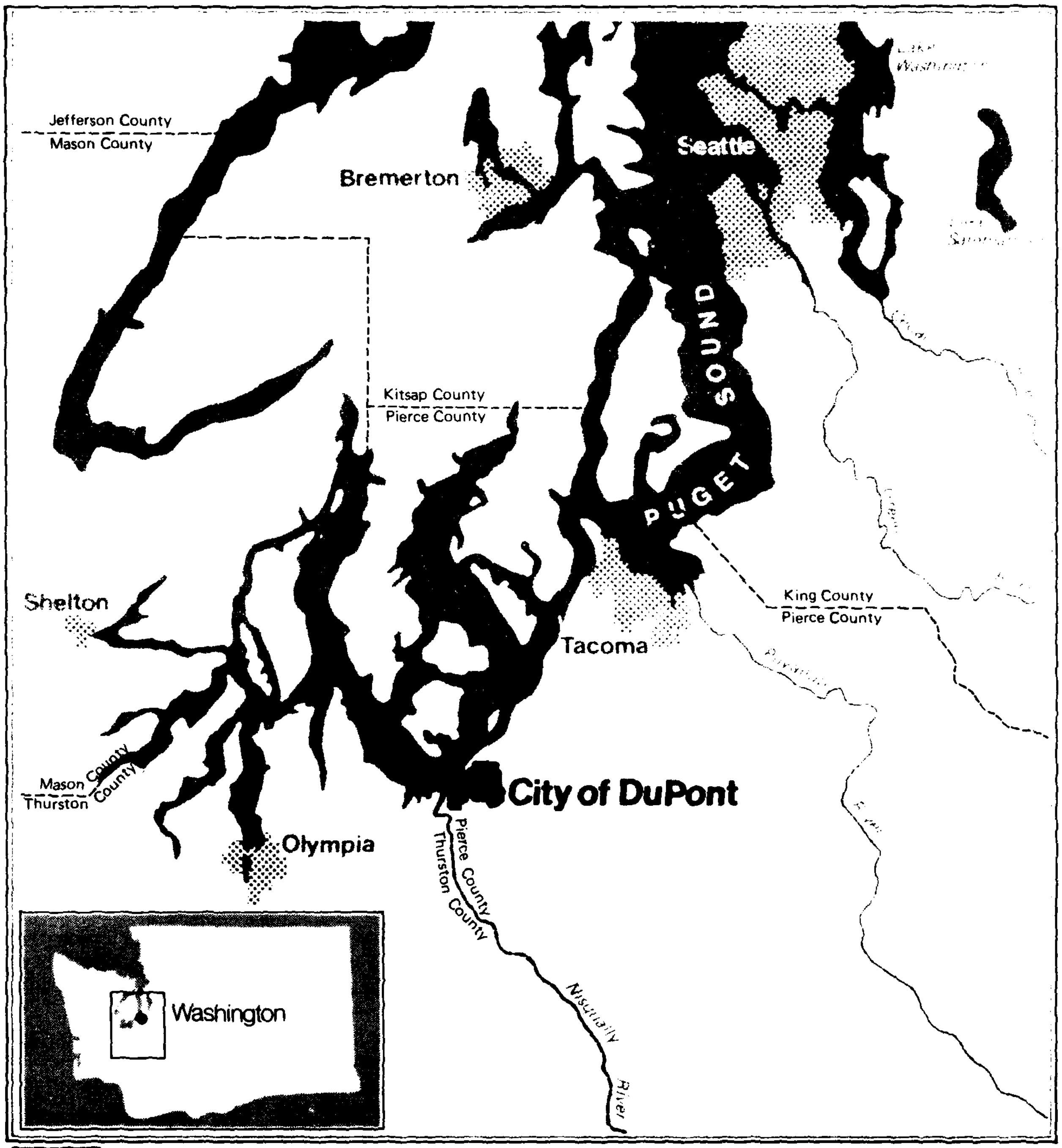


FIGURE 4
VICINITY MAP

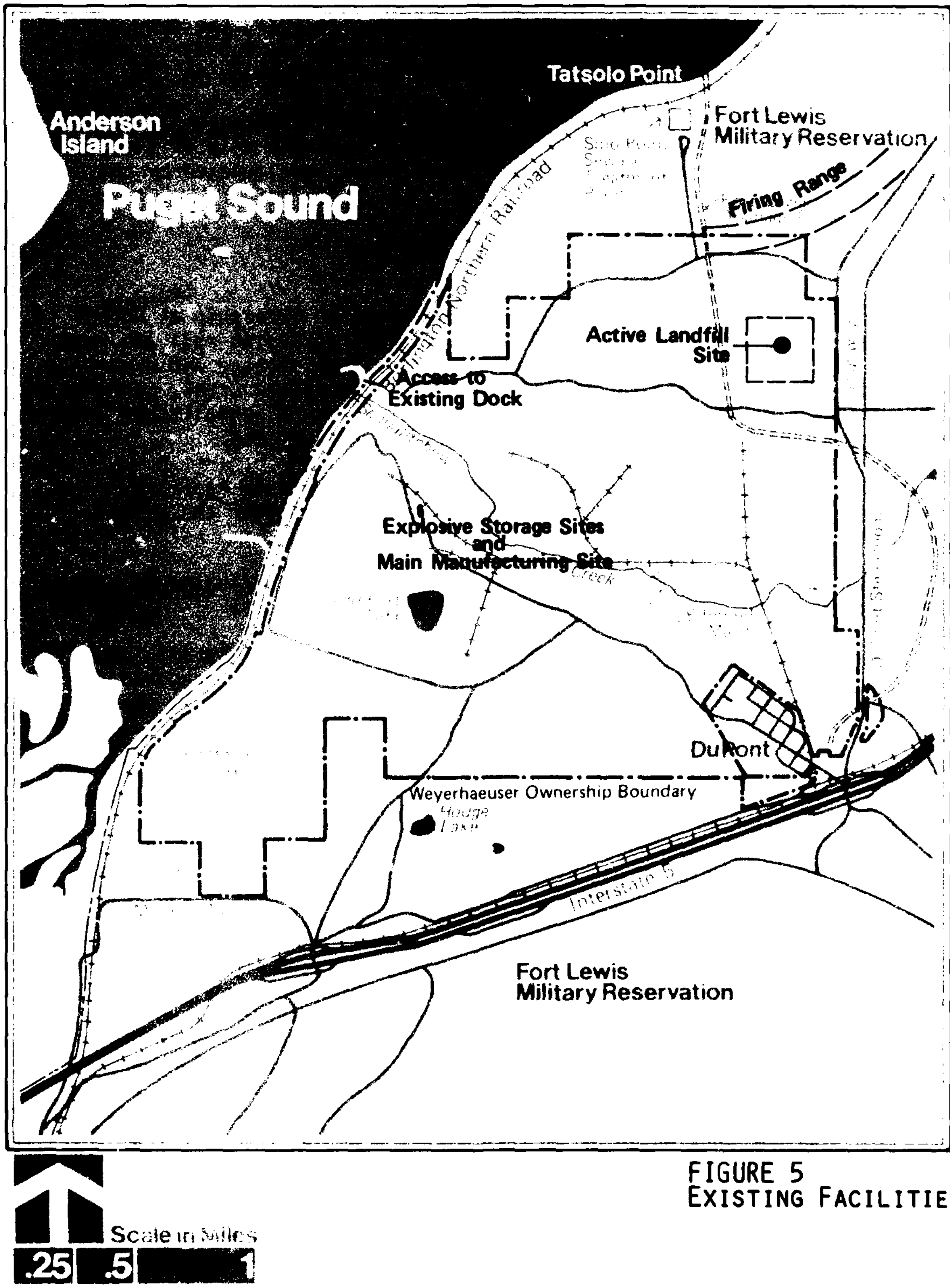


FIGURE 5
EXISTING FACILITIES

incorporate the community as the City of DuPont. In 1971, the city annexed approximately 3,200 acres of adjoining land owned by the duPont Company (Figure 5). This land was purchased by Weyerhaeuser Company in 1976.

In 1978 Weyerhaeuser exchanged 40 acres of the 3,200 acre parcel to Lone Star Industries for 22 acres plus approximately one-half mile of tidelands immediately north of the city limits. These lands were annexed by the city on January 30, 1980.

1.3 PHYSICAL DESCRIPTION

Approximately 250 acres within the Weyerhaeuser ownership at DuPont would be dedicated to export-facility activities, including rail and road access rights-of-way of approximately 25 acres. The storage and export-related activities would be located north of Sequalitchew Creek, centered in the southwest quarter of Section 23. The area south of Sequalitchew Creek would be directly affected only by the road and rail access.

Figure 6 identifies the main features of the proposed facility. Figures 2 and 3 show the proposed project superimposed over the existing site from two perspectives.

The main features of the proposed export facility including dock and vessels are:

a. Dock and necessary loading equipment--two dock locations have been assessed in this EIS (Figures 2 and 7). The proposed dock (identified in the public notice dated 23 January 1981 presented in Appendix A) would be located at the site of the existing DuPont wharf, which would be removed. The alternative dock location (previously identified as Weyerhaeuser's proposed dock location in public notices dated 31 August 1978, 1 July 1979, and 4 September 1979 presented in Appendix A) would be north of the existing wharf and would extend north of Sequalitchew Creek as shown in Figure 7. Design would be essentially the same for both dock locations. The dock would be a low profile structure approximately 140 feet wide and 1,315 feet long. The proposed dock would form a T with the causeway, extending along the 60-foot depth contour. If located in the alternate location, the dock would extend in a northeasterly direction generally parallel to the shoreline roughly along the 60-foot depth contour. The dock in either locations would be capable of serving ships with a draft requirement up to about 50-feet. No initial or maintenance dredging or filling would be expected. The dock would be unprotected by jetties and fully exposed to the Nisqually Reach. The access causeway from the shore to the dock would be 57 feet wide and would originate from shore at approximately the same place for both dock locations. Initially no cranes would be located on the dock. The open hatch-type vessels to be used are equipped with cranes. The dock would be designed and engineered to permit installation of cranes at some future date if ship design required. The dock would also be capable of accom-

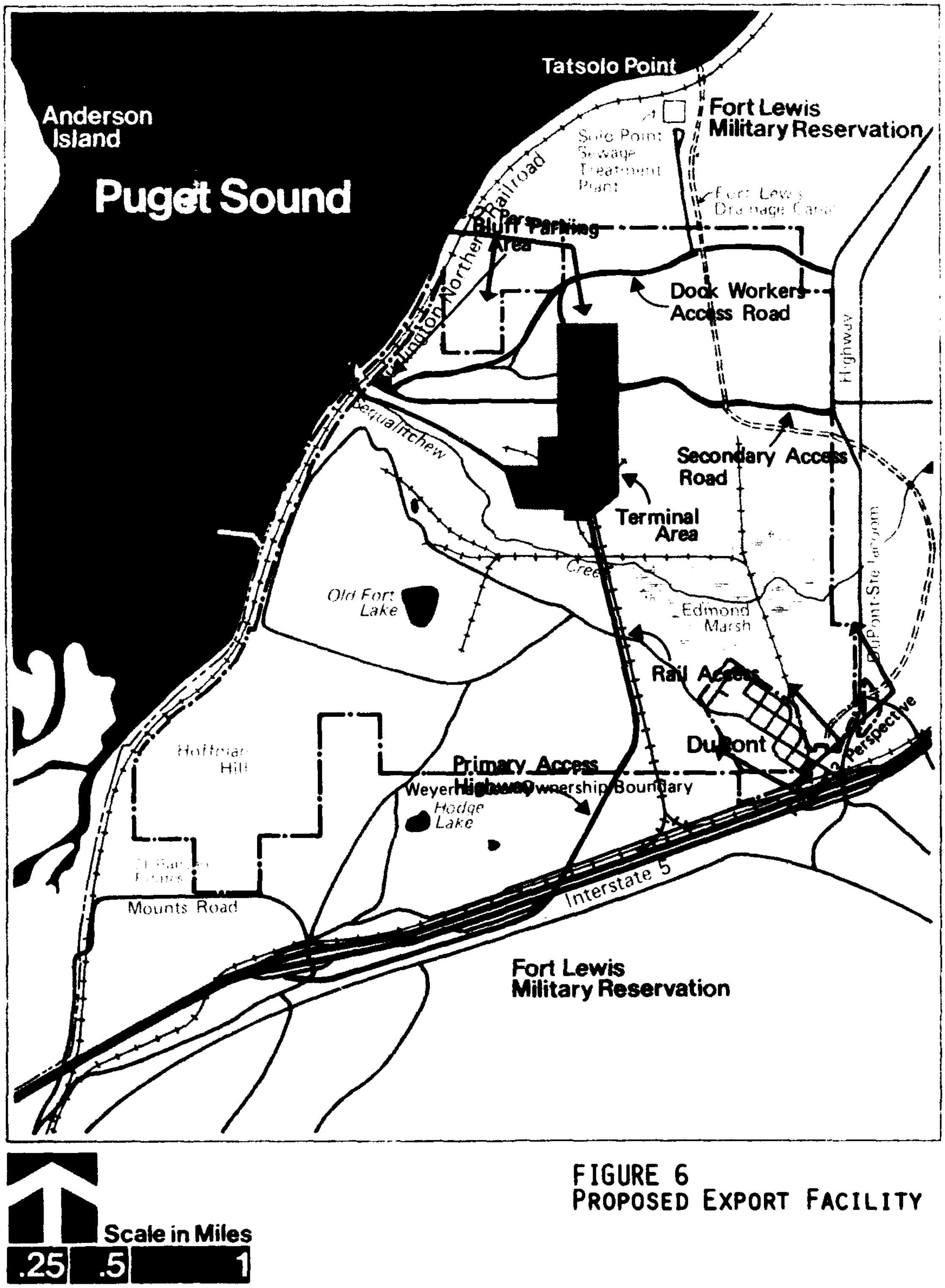


FIGURE 6
PROPOSED EXPORT FACILITY

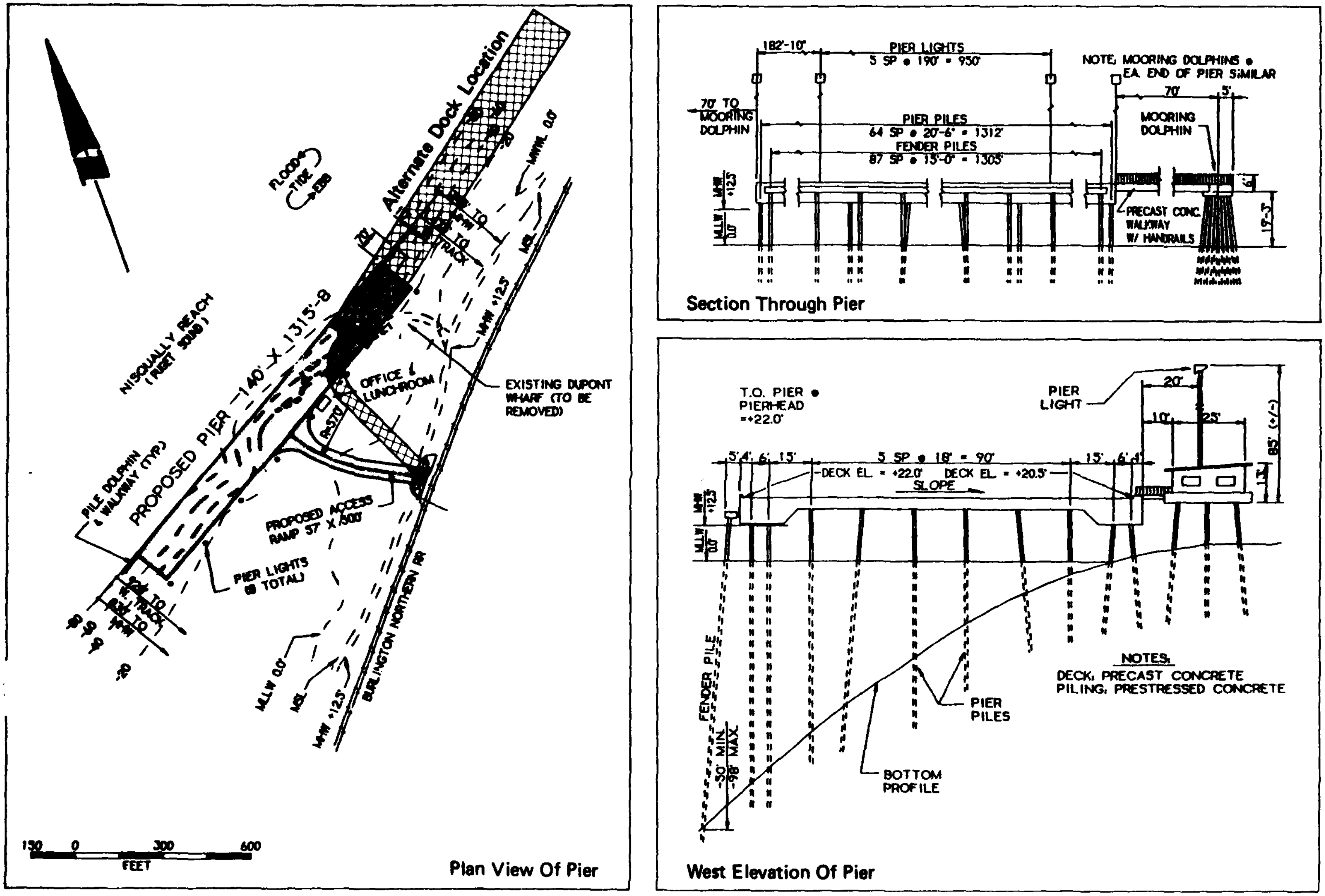


FIGURE 7
DOCK DESIGN

modating roll-on/roll-off loading. A small, one story building on the dock would provide a supervisory office and lunchroom for the longshoremen. Parking for dock workers and others needing access to the dock would be provided in a gravel parking lot on top of the bluff (Figure 6).

b. Vessels--from 70 to 95 vessels per year would load at the proposed export facility at project start-up. The most likely number of vessels per year during start-up would be 88 (see Appendix B, DuPont Port Call Analysis, for more detail). Two to five days would be required to load a ship, depending on its capacity. At any one time, one large ship or two smaller ones could be moored at the dock. As shown in Table 1, six types of ships might be loaded at the facility. These ships would range in length from 610 to 1,010 feet, and have a design draft of 32 to 40 feet and a design load of 28,000 to 78,000 long tons. Only two of these six types of ships are now in operation--the conventional log ships and Weyerhaeuser M-ships. Over time, the trend would be toward a mix consisting of larger ships with fewer port calls. Short-term (start-up to five years) estimates range from 52 to 103 port calls per year, with a most likely number of 78 vessels per year. Mid-term (five to 15 years following start-up) estimates of the number of port calls per year range from 33 to 66, depending upon the mix of vessels serving the facility. The most likely number of port calls per year would be 53. Over the long-term (greater than 15 years following start-up), Weyerhaeuser estimates between 28 and 34 port calls per year by large vessels, with 28 port calls being the most likely scenario.

TABLE 1

EXPECTED RANGE OF VESSELS CALLING AT THE DUPONT EXPORT FACILITY

	Overall Length (feet)	Design Draft (feet)	Deadweight Tonnage (long tons)
Conventional log ships	610	33	28,000
Weyerhaeuser M-ships	660	33	44,000
Next-generation log ships	740	37	50,000
Large open-hatch bulk ships	860	40	76,000
Large Ro-Ro type ship	940	32	42,000
Bulk cargo/deck containers	1,010	35	78,000

c. Rail access--a new rail spur to the export facility would be constructed. It would connect with a wye to the existing Burlington

Northern line at a point adjacent to Interstate 5, about 1.6 miles west of the Mounts Road interchange. As shown in Figure 6, this spur would parallel the new access road and be approximately 1,500 feet from the DuPont village at its closest point. The new rail spur would be owned by a wholly-owned subsidiary of Weyerhaeuser.

d. Primary road access--a new two-lane road would be constructed (at Weyerhaeuser expense) to connect U.S. Interstate 5 to the export facility. The proposed access road would tie into the Mounts Road interchange with a frontage road paralleling Interstate 5. Natural vegetation would be retained on a 65-to-190 foot buffer area between Interstate 5 and the frontage road (Figure 8). The frontage road, located to the south of Interstate 5, would cross the freeway (via an overpass) about 1.2 miles east of Mounts Road interchange. vegetation would be retained on a 65-to-190 foot buffer area between Interstate 5 and the frontage road (Figure 8). The frontage road, located to the south of Interstate 5, would cross the freeway (via an overpass) about 1.2 miles east of Mounts Road interchange. From the overpass, the road would proceed north onto the Weyerhaeuser site. The access route would pass west of the 1843 Fort Nisqually site, cross Sequalitchew Creek, and enter the northern portion of the site where the storage areas and marshaling yard would be located. Maximum grade along this access route would be three percent. The access road would be a private road; however, Pierce County would have the option of assuming ownership at any time.

e. Secondary road access--at least one of the two existing gravelled roadways to the northern portion of the site from the DuPont-Steilacoom Road would be used as for construction access. The southernmost of these two roads would be paved after construction of the terminal facilities and serve as secondary access for personnel, service, and emergency vehicles. See Figure 6 for the locations of these two roads.

f. Roadway between the staging areas and the dock--the route chosen for this road is down the north side of the Sequalitchew Creek Canyon. The paved 54 foot wide roadway with two 20 foot lanes would have a maximum grade of five percent. The road would be a reinforced-earth structure incorporating a retaining wall (Figure 9). Relatively little land on either side of the road would be disturbed. Existing land contours, except under the road, would be unchanged. Other methods of access down the bluff that were investigated are discussed in Chapter 5.

g. Other roads--on-site roads in addition to the access routes and the roadway between the staging area and the dock are shown on Figure 10.

h. A marshalling area--for inbound rail shipments is shown in Figure 10.

i. A storage area for forest products, including log debarking facilities--this area would be located north of Sequalitchew Creek in the

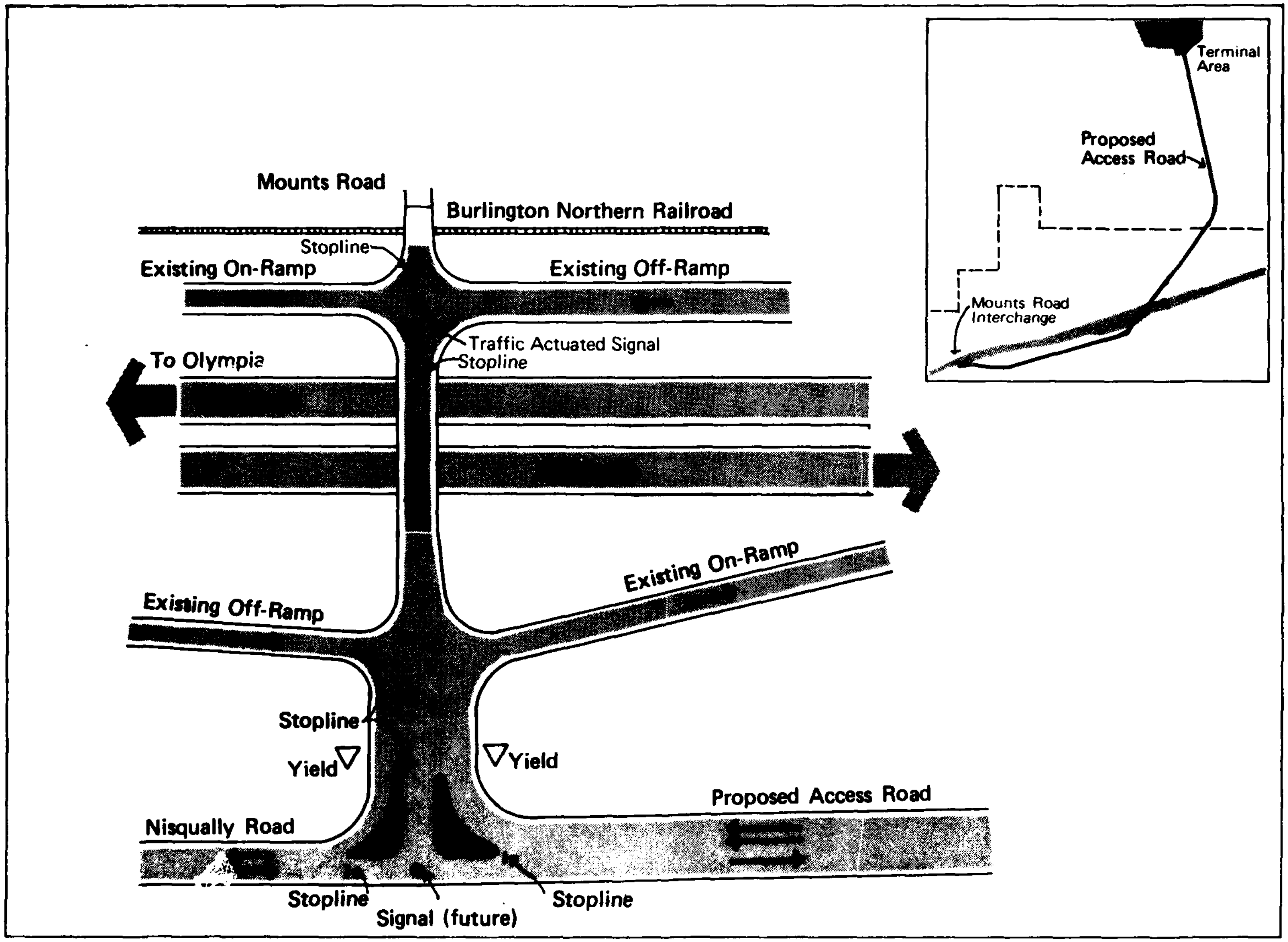


FIGURE 8
PROPOSED IMPROVEMENT TO
MOUNTS ROAD INTERCHANGE

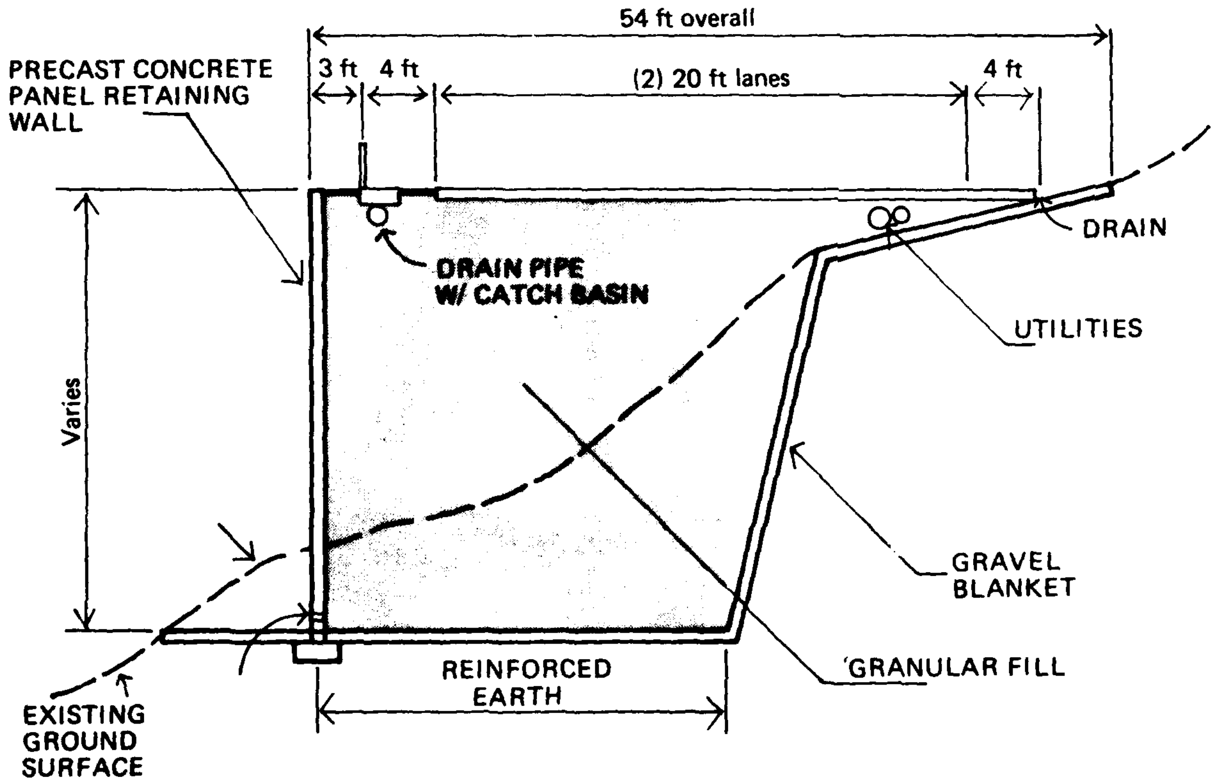


FIGURE 9
PROPOSED REINFORCED EARTH ROAD

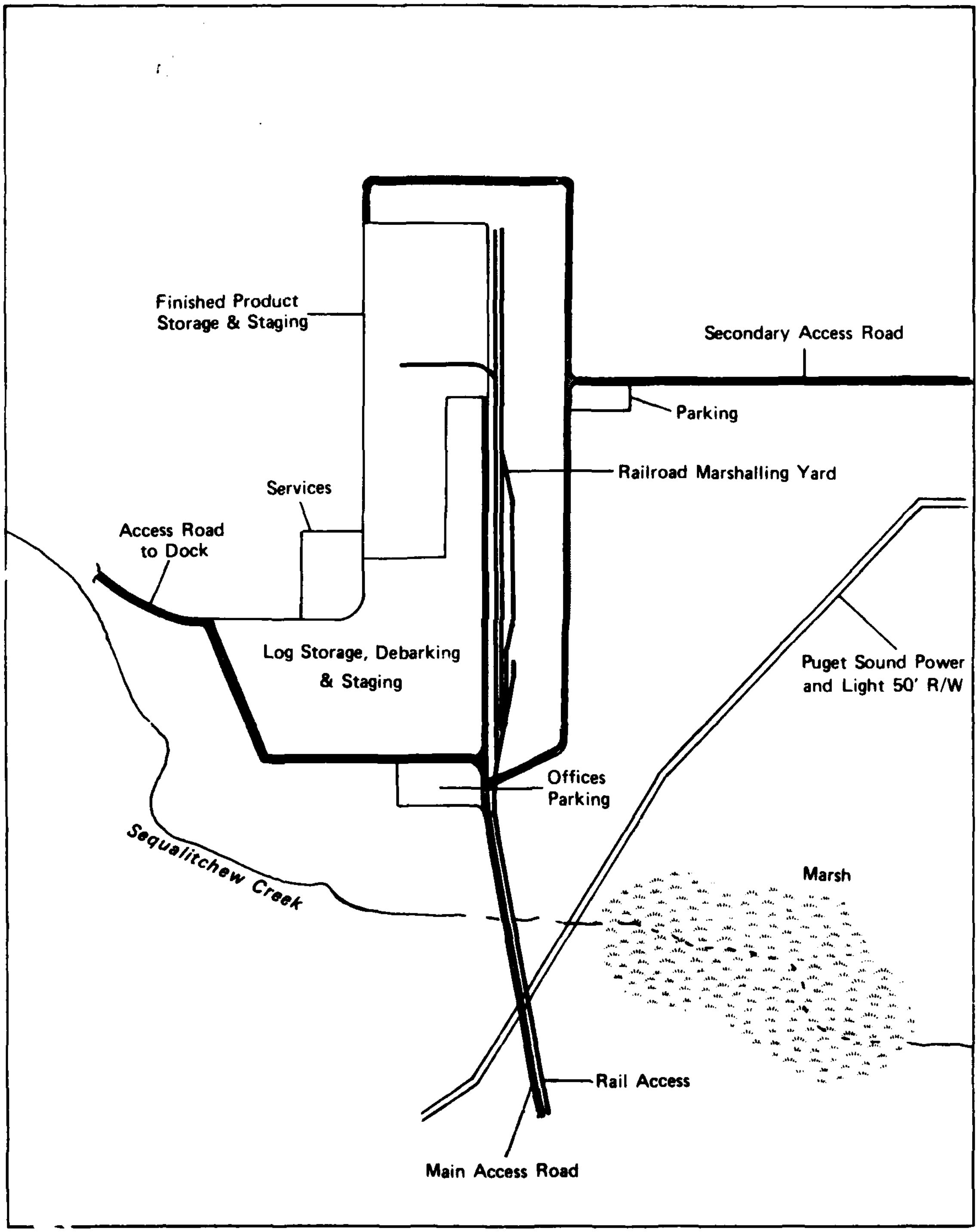


FIGURE 10
TERMINAL AREA
PRELIMINARY LAYOUT

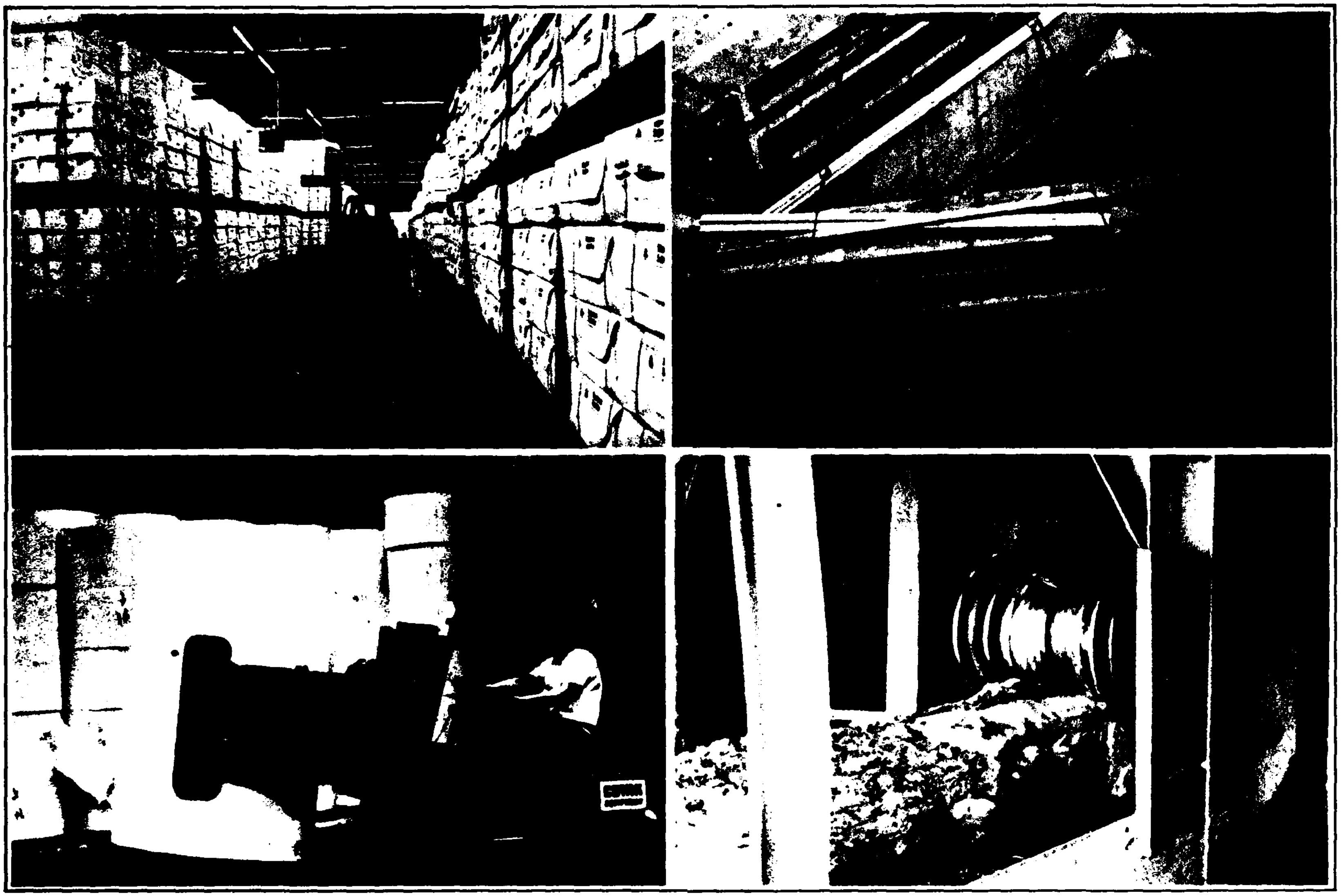


FIGURE 11
TYPICAL FOREST PRODUCTS
HANDLING ACTIVITIES
July 1977

upland area above the new dock, as shown on Figure 10. Several representative product-handling procedures are shown in Figure 11. No product storage or log rafting would occur along the shoreline. Twenty-five acres of paved surface and 15 acres of covered storage would be provided for finished forest products (lumber, pulp, newsprint, linerboard and bleached board). The 55-acre paved log storage area would include space for both debarked and barked logs. Bark from the debarker would be stored on-site temporarily in enclosed bins. Therefore, no runoff or leachate would be generated.

No chips would be generated. The logs would be sprinkled with water as needed to prevent splitting, but would not receive any type of chemical treatment. Runoff would be collected from the log-storage surfaces, passed through a skimming and solids removal system, and recycled or disposed of as described below under Runoff Water Collection and Treatment.

j. <u>Staging area</u>--prior to loading, forest products would be moved from a portion of the storage area to the staging areas, where products would be bundled or containerized. The staging areas would be integral parts of the storage areas rather than separate, definable areas.

k. <u>Wheeled vehicles</u>--when the export facility reaches the design capacity of 2 million tons per year, an average of 95 to 110 trucks and 120 to 165 rail cars (three to eight trains) would come to the site per day, five days per week. The peak rate of arrivals for trucks and trains could be twice the average rate. All types of log and finished product trucks would be used on the roadway between the staging areas and the dock. In addition to trucks, the tractor trailer carriers now used at other Weyerhaeuser facilities and LUF (lift unit frame) type carriers would be used on the road to the dock and on the dock itself. Other vehicles would be used to maneuver products around the site. Movement of products into the export center by truck and train would typically occur Monday through Friday between the hours of 6 a.m. to 10 p.m. During ship loading operations, movement from the staging area onto the dock and onto the ships would occur from 7 a.m. to 11 p.m. every day while a ship is docked until it is fully loaded and prepared to depart. Occasionally loading would continue 24 hours a day.

l. <u>Administration and support buildings</u>--about 1-1/2 acres of the site would be occupied by administration and support buildings (offices, lunch rooms, maintenance shops). See Figure 10 for their locations.

m. <u>Runoff water collection and treatment</u>--in log storage areas, runoff from sprinkling and rain would be directed to settling ponds for reuse in sprinkling logs and fire protection. Ultimately the water would percolate into the ground. In other developed parts of the terminal area, storm runoff would be directed to open unlined ditches. Excess water would be sent (after settling) to a drainage field to percolate into the ground. Storm runoff from the dock and the dock access roadway would be collected and treated. This stormwater runoff would be trapped in holding

tanks, solids settled out, and skimmers used to remove oils before the water is released to Puget Sound. The 158,000-gallon holding tank under the dock would detain runoff from the dock and dock-access road during the most intense 30-minute period of rainfall expected in 25 years. For the DuPont area, this was found to be 0.8 inches/30 minutes for a 25-year event (National Weather Service, personal communication). Bypasses of untreated runoff would therefore occur rarely. The settleable solids would be removed and any oil would be separated prior to discharge to marine waters. Accumulated sludges would be periodically hauled to a landfill. The tank would also retain any fuel in the unlikely event of a spill on the dock or access road. Effective oil-water separation would reduce the oil concentration in the discharged water to less than 10 ppm. These measures, to be most effectively sized and located, are part of the detailed engineering phase. The design would be incorporated by reference into local permits, assuring agencies an opportunity to review, approve, and enforce the plans.

n. Sanitary wastes--in the upland areas, septic tanks would be used. The septic drainfield would be close to the building in the terminal area and at least 500 feet from both the bluff and the creek. Sewage generated on the dock would be trucked or pumped up the hill and discharged in the septic tanks in the upland areas. No industrial wastes would be generated. During loading operations ballast waters would be shifted within the ship and discharged at the dock to maintain proper trim. Such discharges would be from tanks that carry clean seawater, in accordance with federal regulations enforced by U.S. Coast Guard.

o. Parking--most parking lots would be paved and cover about six acres. The longshoreworker-access road and parking lot would be graveled.

p. Fuel--ships would not be refueled at DuPont. Fueling may occur at any of the permitted fueling areas in Puget Sound such as the fuel barge in Elliot Bay. Alternatively, fueling may occur in foreign ports or in any other United States ports where the ships load or discharge cargo (Tacoma, Portland, San Francisco, Los Angeles, etc.). No new fueling sites would be required. Fueling may occur before or after calling at DuPont. Specific types of ships to be used are not known at this time. Fuel capacity of the M-ships is 3,350 long tons of bunker fuel and 406 long tons of diesel oil. Small log ships would have 1/3 to 1/2 this capacity, while a 70-80,000 ton vessel might hold 1-1/2 times as much as the M-ships. Most on-site trucks and tractors would refuel at the terminal site on top of the bluff. Only vehicles operating primarily on the dock would be refueled on the dock by a fuel truck. A fuel truck (2,800-gallon capacity) would be on the dock only when it is fueling dock equipment.

q. Groundwater usage--groundwater would be used for fire protection, drinking water, toilets and washrooms, log sprinkling, potable water for vessels, and sprinkling of gardens and lawns. Groundwater withdrawal would amount to 310,000 gallons per day in the summer plus any water required for fire fighting.

r. <u>Energy requirements</u>--electrical-power requirements would range from 6.2 to 8.3 million kilowatt hours per year. Annual fuel demands on-site are expected to be 500,000 to 600,000 gallons of diesel, 80,000 to 100,000 gallons of propane, and 4,000 to 5,000 gallons of gasoline.

s. <u>Abandonment of existing facilities</u>--the Barksdale Road leading out of the Village of DuPont to the DuPont Powder Works industrial site would be abandoned, as would the existing railroad spur through the village. The existing wharf would be removed.

1.4 PROPOSED CONSTRUCTION

Construction of the proposed export facility would start after all required permits were received and continue for 24 to 30 months. (This schedule is tentative. For example, factors such as availability of funds could lengthen or shorten the time required for completion.) Construction costs are estimated at $48 to $84 million (in 1981 dollars). Assuming a two-year construction period, the number of construction workers employed would average 120 to 210.

Total construction costs would be allocated among various expenditure categories approximately as shown below:

Engineering	10%
Construction Management	5%
Construction Labor	30%
Capital Equipment	20%
Construction Materials	30%
Construction Equipment Rental	5%
Total	100%

Of these, the expenditures for construction management, construction labor, and rented construction equipment would be made within the southeastern Puget Sound region. It is expected that construction skills for development of the facility would be available in the southeastern Puget Sound region.

Construction activity would be expected to peak during the middle 12 months of construction. Thus, for the first six months, 70 to 120 construction workers would be employed, using 15 percent of the total construction budget. For the second and third six-month periods, peak employment would range from 170 to 300 workers as 70 percent of the budget is expended. For the final period, employment would return to the 70 to 120 workers as the remaining 15 percent of the construction budget is used.

During construction and prior to completion of the main highway access route, access to the terminal area would be provided via the DuPont-Steilacoom Road (Figure 6). The existing on-site dirt road, which would be used by construction employees and to haul construction materials, would be graded

and maintained by Weyerhaeuser. None of the construction traffic would use Barksdale Avenue, although its intersection with DuPont-Steilacoom Road would be used. The dock would be constructed from the waterside, using barges.

1.5 PROPOSED OPERATION

The proposed facilities would provide a central location for receiving products from company manufacturing and woods operations in Western Washington and allow rapid loading for export of large volumes of forest products into ocean-going vessels.

The facility has been designed to handle a variety of forest products, such as logs, lumber, pulp, newsprint, linerboard, and bleached board. Some of the forest products now shipped from existing facilities (primarily those at Tacoma, Longview, and Everett) would be shipped from the facility. The sole purpose of the facility is handling forest products for offshore markets. No imported cargos or non-forest product cargos are currently anticipated, although the facility may have limited use for these purposes if for example, other facilities are temporarily unavailable.

Operation of the facility would begin almost immediately upon completion of the dock, access roads, and staging area. Design of the facility would retain maximum flexibility to accommodate regional changes in sources of supply and external changes in the forest-product market. Therefore, the product mix to be handled by the facility cannot be specified with certainty. Within five to ten years, export volume would be expected to reach two-million tons per year of finished products and raw materials combined.

Products would be delivered to the site by rail and truck transport and exported by ship. To operate at the design rate, the facility would require an average of three to eight train deliveries (from 120 to 165 cars) and from 95 to 110 truck deliveries per day. At the design rate, an initial average of about 7.5 ships per month would load at the dock. Over the long-term, this average would decrease to about 2.5 ships per month as anticipated ship size increases. Products received at the facility from company operations would be unloaded and placed into storage.

Other on-site activities would include those associated with vendors of operating supplies and services.

Employment after startup is estimated at 130 to 165 workers (in addition to longshoreworkers). No significant seasonal variation of employment would be expected. Employment levels may vary somewhat with changes in the export volume.

The regular work force would consist of warehouseworkers and related labor categories augmented by a small administrative staff. Remaining on-site employees, such as security guards and buildings and grounds maintenance workers, would be hired on a contract basis.

Of the regular work force required by the facility, as many as 38 workers might be transferred from existing Weyerhaeuser operations at the Tacoma log-export facility. These workers would constitute the core group of

specially skilled workers needed for immediate handling and staging of logs for export. Of the contracted service work force, some (primarily security guards) are currently employed on-site and would be retained during facility operation.

At design volume, which would be anticipated near the year 2000, dock-related activities of the facility would support an estimated annual equivalent of 17 to 21 longshoring jobs in addition to the on-site work force. Because the point of shipment of two-million tons of forest products per year would be moved from conventional facilities at Everett, Longview, and Tacoma to the eventual large-vessel operations at DuPont, overall longshoreworker requirements at Weyerhaeuser's operations would be reduced by an annual equivalent of 37 to 46 jobs. The reductions would occur at:

Location	Annual Equivalents
Everett	3 to 3-1/2 jobs
Longview	15-1/2 to 19-1/2 jobs
Tacoma	18-1/2 to 23 jobs

1.6 ANALYSIS OF POTENTIAL FUTURE DEVELOPMENT

The 250-acre export facility is the only project presently planned by Weyerhaeuser for the 3,200-acre site (Appendix B). (This environmental impact statement covers construction and long-range use (over 20 years) of the proposed export facility.) Weyerhaeuser has identified in its major long-range plans an economic need for an export facility that could accommodate ocean-going ships for exporting forest products to offshore markets.

The DuPont site was originally selected by Weyerhaeuser for four major reasons:

a. the adjoining waters can accommodate ocean-going ships (of the size Weyerhaeuser plans to use) without dredging;

b. the site is central to most of the Weyerhaeuser western Washington forests and plants, thus minimizing truck and rail transportation costs;

c. the upland site is zoned industrial and has potential capability for future manufacturing operations;

d. the site was available for purchase.

Because the DuPont site encompasses a much larger area than is required for the export facility, industrial facilities could eventually be proposed for and developed on the site. During planning for the proposed export facility, Pereira and Associates, at Weyerhaeuser's suggestion, sought to maintain maximum flexibility for possible future development of the site.

Weyerhaeuser and the U. S. Fish and Wildlife Service (FWS) have jointly prepared a memorandum of understanding (MOU) that limits development in

certain areas of the Weyerhaeuser-DuPont site. This will be approved by the Washington State Department of Ecology (WDE). Weyerhaeuser Company has agreed to sign the MOU; the FWS has indicated the final decision to sign the MOU will be dependent on their review of the FEIS. As part of this MOU, Weyerhaeuser, WDE, and FWS would jointly recommend to the City of DuPont that certain areas be redesignated from "urban" to "conservancy" in the city's Shoreline Management Program, designated as "conservation areas" in any City Comprehensive Plan, and zoned accordingly. Further details of the Weyerhaeuser-FWS-WDE MOU are featured in Section 3.3, in Figure 49, and in Appendix K. Implementing features of the MOU are contingent upon the proposed export facility being constructed.

When a decision is made to build a new facility, such as a lumber mill, Weyerhaeuser has stated that it normally investigates all present land holdings and potential lands for acquisition before deciding where to locate the new operation (Appendix B). DuPont undoubtedly would be a candidate site for any major projects that Weyerhaeuser considers in western Washington.

Any future development at DuPont would require a complete, new, independent review by all applicable government agencies, based on the regulations and policies in effect at that time. Any future proposals would be judged in light of the then-existing conditions. Cumulative impacts of the export center and any future upland proposals would then be considered.

It should be noted that the Corps of Engineers would not be involved in the environmental assessment of future upland developments that do not involve construction in navigable waters or their adjacent wetlands. However, any future plans that involve development of additional docks in the Southern Puget Sound Region would require a complete review by all applicable government agencies, including the Corps of Engineers, based on the regulations and policies in effect at that time. If the proposed DuPont dock is permitted, the cumulative impacts of that dock and shipping and future docks and shipping in the region would be considered at such time as the applications for such docks/shipping were received.

2.0 Environmental Setting of the Project Area

To assess the magnitude and significance of potential environmental changes associated with the proposed export facility at DuPont, a thorough understanding of the existing environment is needed. Therefore, for each environmental component, the intial section provides a description of the environment that could be affected by the proposed project. The environmental assessments described in this chapter are based, in part, on a series of baseline studies. At the beginning of each subsection, the baseline study used is cited. Since the purpose of these sections is to establish a baseline against which potential impacts can be measured, the discussion emphasizes those areas where the greatest potential for environmental change exists. Aspects of the environment that have been of public concern are also emphasized whether or not they are expected to involve major environmental change.

Although the proposed project would directly affect only a portion of the 3200-acre site, data for the entire site are discussed to provide a perspective on secondary or indirect impacts and to serve as a baseline for any future development of the site. Data on the flora and fauna of the Nisqually Delta provide a regional perspective and reflect public concern for these elements.

2.1 EARTH

This section summarizes data on the topography, geology, soil, and mineral resources of the site. The major geologic hazards (erosion, slope failure, and earthquake damage) are evaluated. More detailed, site-specific information on these features is provided in reports prepared for Weyerhaeuser (Duncan, 1977 and Hart/Crowser, 1976).

2.1.1 Topography

Most of the DuPont site is characterized by gently rolling to nearly level terrain about 200 feet above sea level, as shown in Figure 12. Kettle depressions formed by melting blocks of glacial ice are found throughout the site. Small lakes or marshy areas occupy some of these kettles, as shown on Figure 13. Several depressions in the southeastern corner of the site are marshy. Sequalitchew Creek passes through the largest of these, Edmond Marsh, then descends through a steep-sided ravine to Puget Sound. This ravine is 160 to 200 feet deep at the lower end. Slopes of the bank range up to 80 percent (100 percent being at a 45° angle) in some sections. The site is bordered along the Sound by a steep (25 to 60 percent slope) bluff. The highest point on the site is Hoffman Hill (elevation 397 feet). Areas with slopes of 15 percent or more are shown on Figure 14.

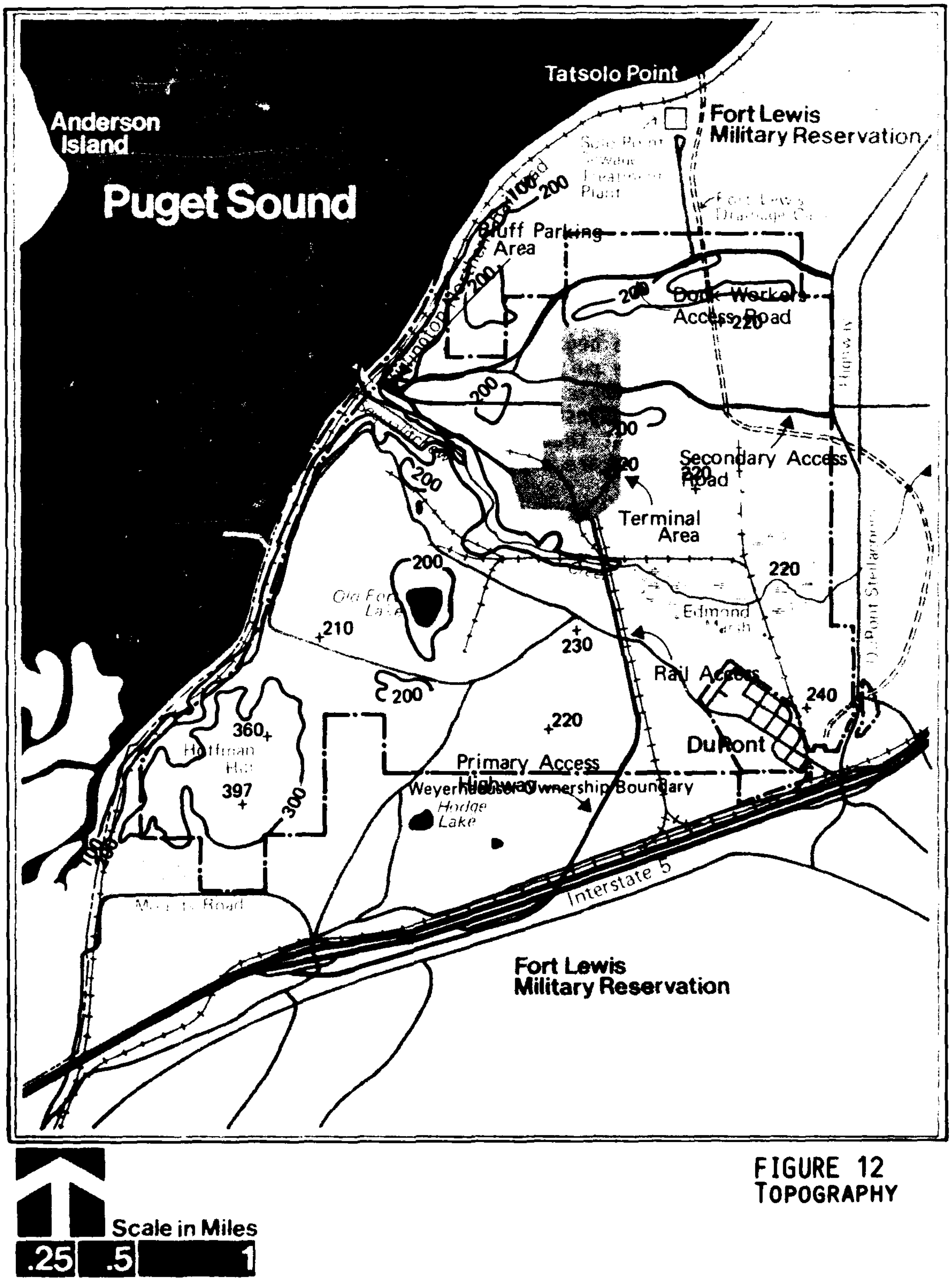


FIGURE 12
TOPOGRAPHY

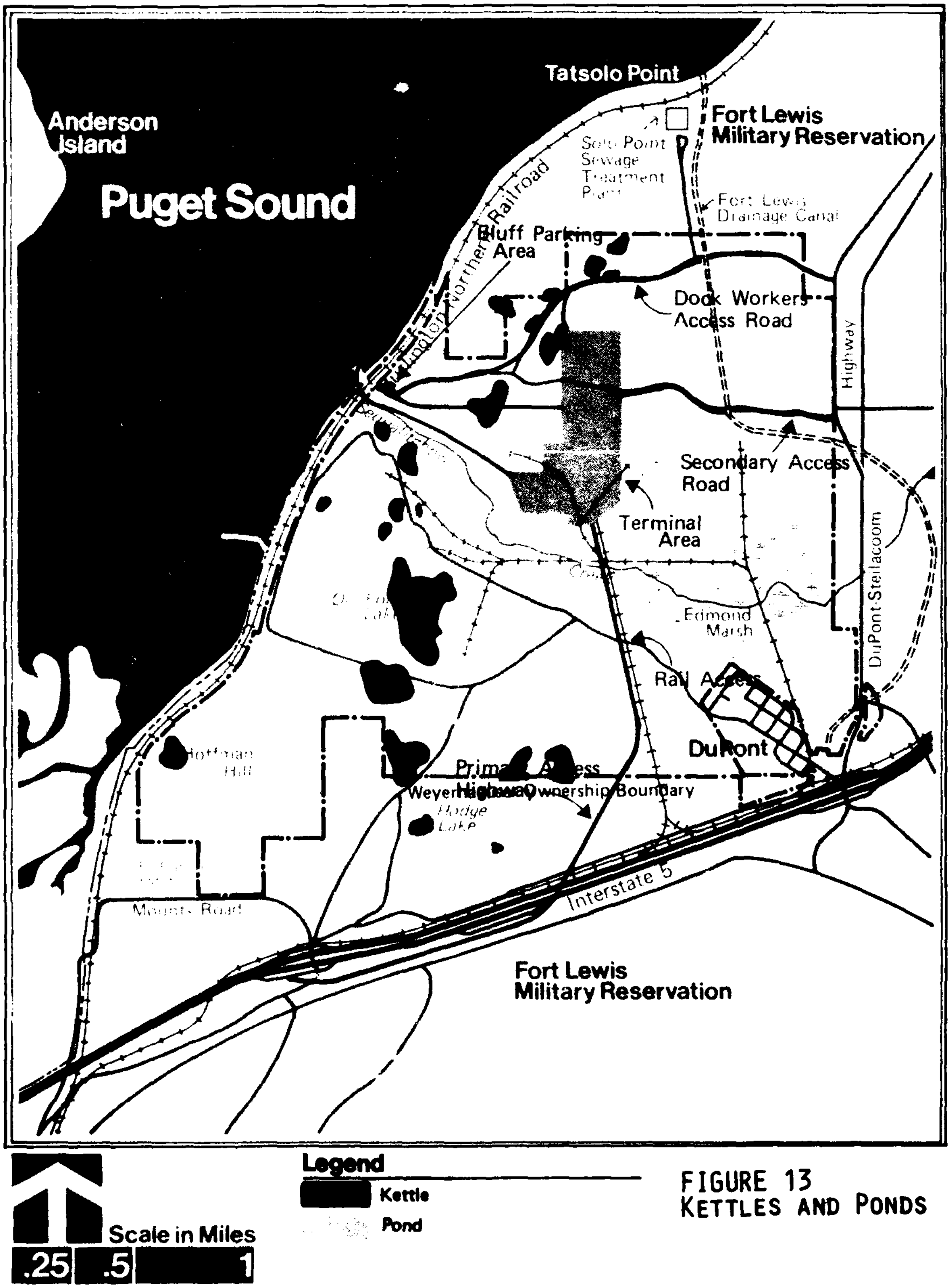
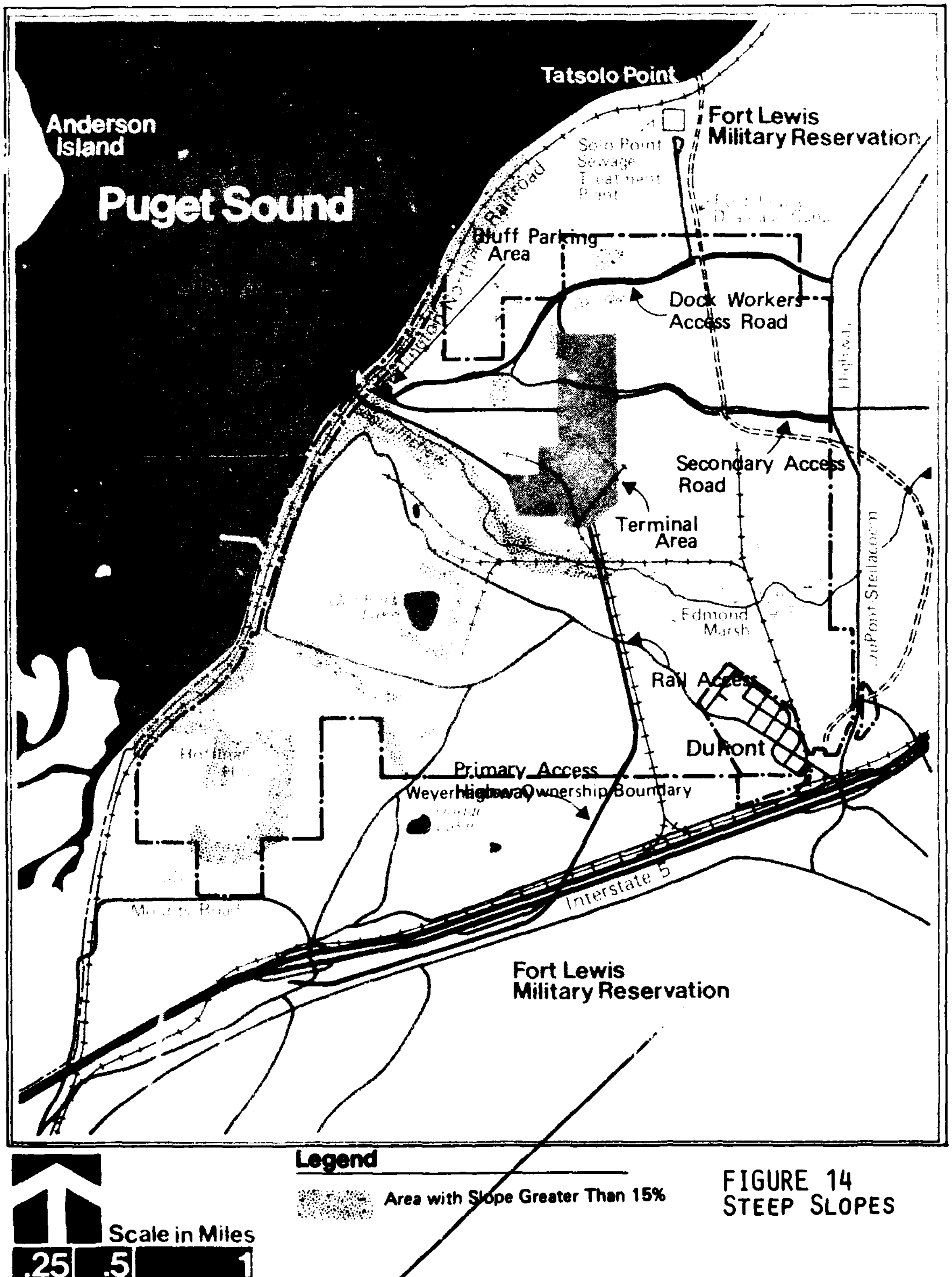


FIGURE 13
KETTLES AND PONDS



Legend

Area with Slope Greater Than 15%

FIGURE 14
STEEP SLOPES

Offshore, at the north end of the site (near the DuPont wharf), water depth increases rapidly, reaching a depth of 300 feet within 1500 feet of the shore. Bathymetry of the adjacent waters is shown in Figure 15.

2.1.2 Geology

The site is located in the Puget Sound lowlands, a broad trough between the Olympic and the Cascade ranges. The underlying formations consist of a layer of unconsolidated materials, over 2,000 feet thick, laid down during the most recent glaciation of the region.

The site lies in the upland glacial outwash plain that covers much of central Pierce County. This plain consists primarily of sand, gravel, and till deposited during the Vashon period, approximately 12,000 to 15,000 years ago (Duncan, 1977).

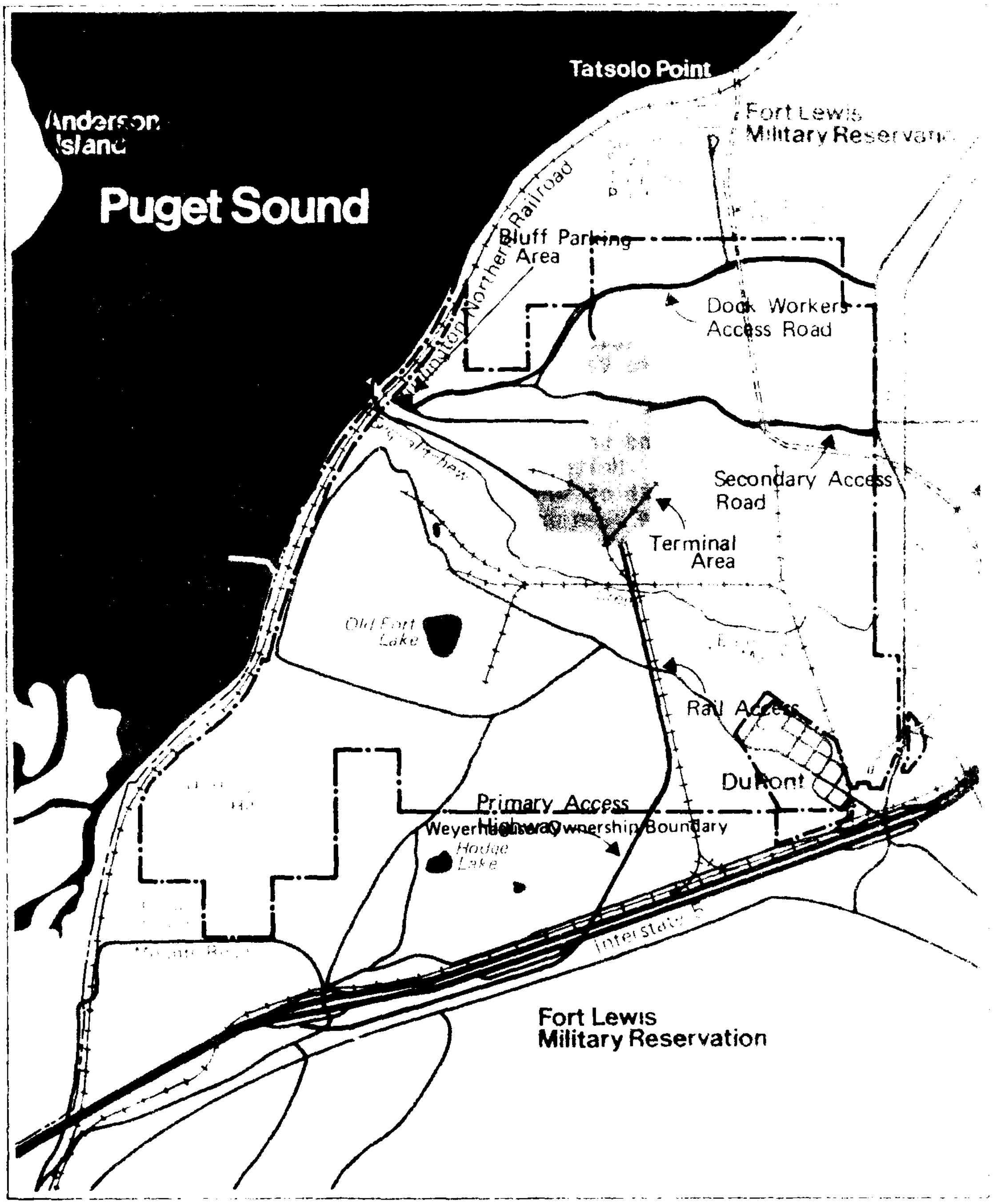
The relative age and positions of the geologic units on the site are shown in Figure 16. Units are listed in order from youngest (most recent) to oldest. Depth of surface deposits (depth to bedrock) is unknown. Wells in the region have been drilled as deep as 2000 feet without encountering bedrock (Walters and Kimmel, 1968). Table 2 provides descriptions of deposits shown in Figure 16.

Steilacoom gravel, which dominates the site (Figure 16), is a consistently coarse gravel (pebbles 1-inch to cobble size), varying in thickness from less than 20 feet to about 200 feet at the mouth of the Sequalitchew Creek. Many kettles or depressions occur on the surface of the Steilacoom gravel.

Areas of recessional outwash materials also occur on the site (Figure 16). Recessional outwash consists chiefly of stratified sand and gravel deposited by the melting glacier. The gravel at the surface is underlain in most places by Vashon till, usually 20 to 30 feet thick. Colvos sand and Salmon Springs drift underlie the region at about sea level. The Salmon Springs drift was deposited during the Salmon Springs glaciation about 35,000 years ago (McKee, 1972) and does not outcrop on the DuPont site.

Much of Hoffman Hill is covered with glacial till and undifferentiated Vashon drift materials. Kitsap formation and Colvos sand are exposed on the bluff along Puget Sound in Section 28 (Figure 16.) Kitsap formation also occurs along Sequalitchew Creek, east of its mouth. A more detailed analysis of the geology of the site has been provided by Duncan (1977).

Sediments near the existing pier consist primarily of poorly stratified to unstratified, gravelly, well-graded sand and sandy gravel. These materials are derived principally from gradual gravity wasting of the adjacent bluffs. The upper 44 feet of a boring taken south of the mouth of Sequalitchew Creek contained very loose to moderately dense, silty, slightly gravelly sands probably derived from alluvial materials washed offshore by the discharge from Sequalitchew Creek (Hart/Crowser, 1976).



*Contours in feet

FIGURE 15
BOTTOM BATHYMETRY IN MARINE WATERS BORDERING THE PROPOSED FACILITY

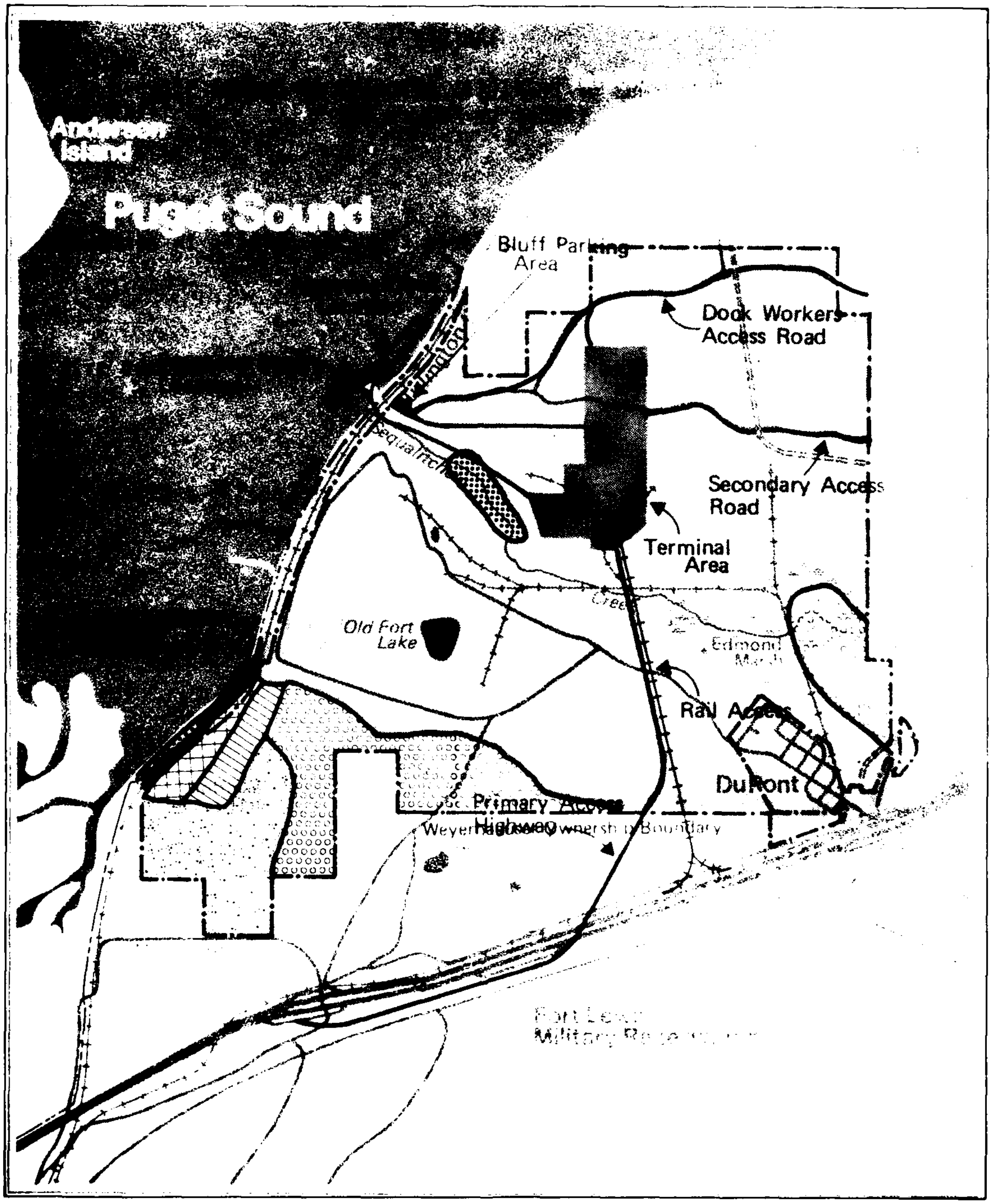


FIGURE 16
SURFICIAL GEOLOGY

TABLE 2

DESCRIPTIONS OF SURFICIAL DEPOSITS OF DUPONT SITE
(Refer to Figure 16)

Steilacoom Gravel

Pebble to cobble gravel and boulders. Occurs chiefly in northwestern part of project area.

Recessional Outwash

Principally stratified sand and gravel, but locally contains silt and clay.

Till

Compact unstratified clay, sand, and gravel. Locally contains cobbles and boulders.

Advance Gravel

Principally stratified sand and gravel, but may contain silt and clay in matrix. Generally more compact than Recessional Outwash.

Colvos Sand

Principally sand, but includes some gravel and a basal, silty clay.

Kitsap Formation

Unoxidized sand and gravel in lower part. Middle part consists of clay and peat, and the upper part of unoxidized sand and gravel.

2.1.3 Soils

Soils of the Spanaway and Everett series cover 80 percent of the site, including all of the area that would underlie the proposed facilty. These soils are characterized by slow surface runoff, rapid internal drainage, high rock content, and low agricultural yields. They provide good foundations, but have poor cutbank stability (i.e. they do not stand well in cuts after excavation). The major limitations of these soils for construction are those imposed by slope in areas of steep or broken relief along drainageways, on escarpments, or on bluffs.

Soils on the site are shown in Figure 17. Several characteristics of these soils are listed in Table 3. More detailed discussion is available in Duncan (1977) and Anderson et al. (1955).

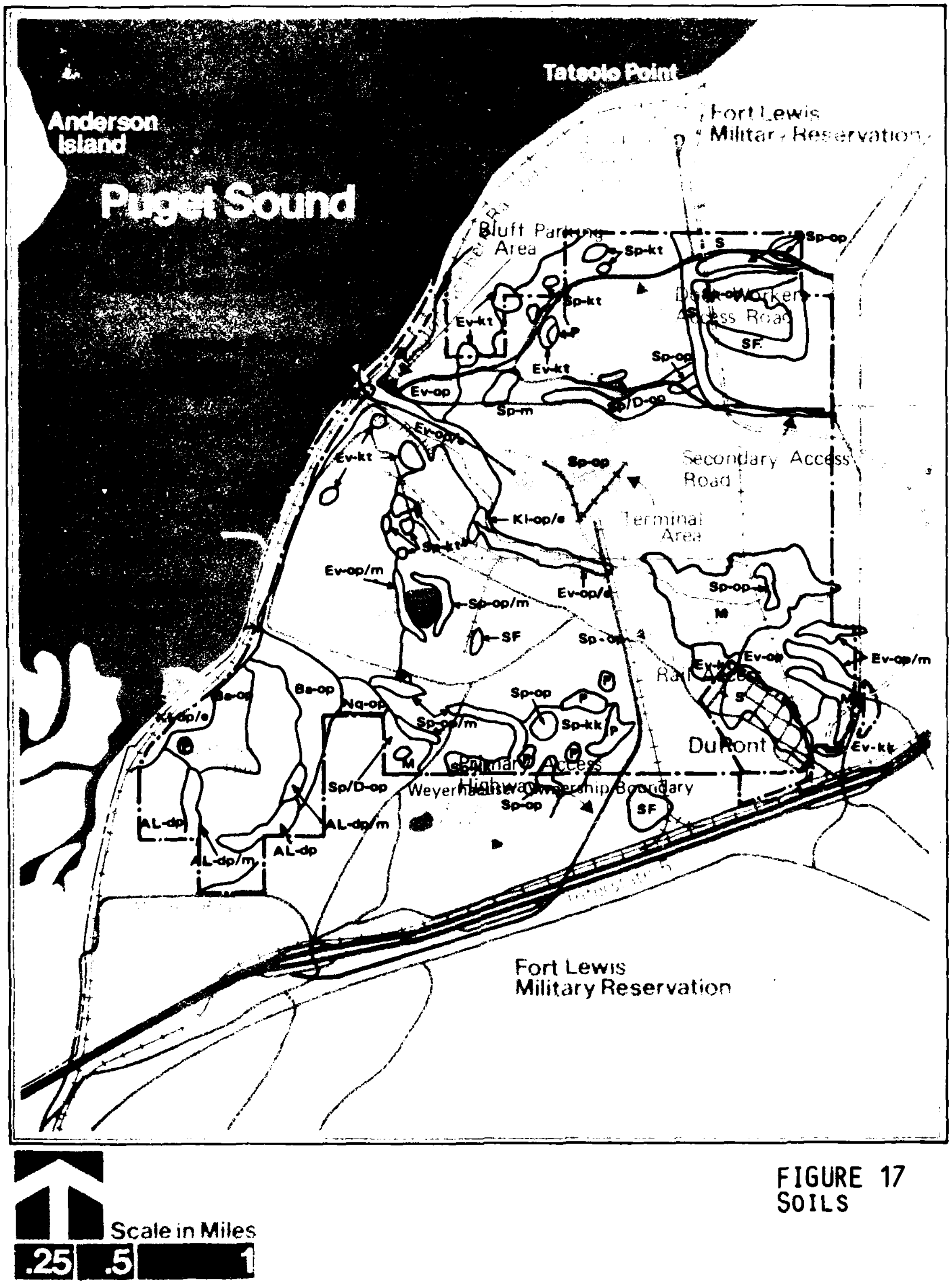


FIGURE 17
SOILS

KEY TO FIGURE 17

Each mapping unit is identified by a symbol that represents both the soil series and landform found within that unit. The symbol for a soil series is written first and separated from the landform portion of the symbol by a hyphen (-). In the case of soil phases, the series symbol is written first, then the phase and the two separated by a slant line (/). Modifications of landforms are shown in the same way. Soils series symbols are written with the first letter capitalized; landforms and modifications are written with lower case letters. The letter L is always capitalized to prevent confusion with slant lines.

Example 1. Soil-landform

Sp-op (Soil-landform symbol)

Sp - Spanaway soil series
-op - outwash plain

Example 2. Soil phase-modified landform

Sp/D-op/m (Soil-landform symbol)

Sp - Spanaway soil series
/D - Deep phase
-op - outwash plain
/m - moderate slope 20-40%

Legend

Soil Series

Symbol	Series
AL	Alderwood
Ba	Barneston
Ev	Everett
Ki	Kitsap
Nq	Nisqually
Sp	Spanaway

Landform

Symbol	Landform
dp	drift plain
kk	kettle kame
kt	kettle
op	outwash plain

Soil Series Phase

Symbol	Series
/D	Deep phase

Modifications

Symbol	Landform
/e	escarpment slope > 65%
/m	slope 20-40%
/s	slope 40-65%

Miscellaneous Classes

Symbol	Class	Symbol	Class
L	Lake	S	Man-made structure
M	Muck	SF	Sanitary landfill
P	Pond	TM	Tidal marsh

TABLE 3

CHARACTERISTICS OF SOILS ON THE DUPONT SITE

Soil Series	Physical Characteristics	Parent Material	Agricultural Capability Class	% of Area	Limitations* for Septic tanks	Limitations* for Foundations	Stability
Spanaway	Old prairie-like soils with black, highly organic topsoil; subsoil is 70-90% gravel	Steilacoom	6	58.7	Potential groundwater contamination	Slight	Poor
Everett	Deep, excessively drained, coarse textured soils; subsoil is 90% rock	Steilacoom gravel	9	21.3	Potential groundwater contamination	Slight	Poor
Alderwood	Moderately shallow, well-drained, coarse textured soils; subsoil is 30-60% gravel	Vashon till	5	5.1	Severe	Slight	Moderate (subject to ravel)
Dupont Muck	Poorly drained, highly organic soils underlain by sedimentary peat; high mineral content	Organic material	1	3.6	Severe	Severe	Poor
Barneston	Deep, well-drained, coarse-textured soils; subsoils 60 to 80% gravel	Recessional outwash	9	3.4	Potential groundwater contamination	Moderate	Good (some dry ravel)
Kitsap	Deep, imperfectly drained, fine textured soils that may contain 20% gravel at the surface when occurring on steep escarpments	Kitsap formation	10	1.4	Severe	Severe	Poor
Nisqually	Deep, rock-free soils of fine to medium sand and sandy loam texture	Recessional outwash	5	1.1	Slight	Slight	Poor

*For slope typical of this series on Dupont site

Source: Anderson, et al, 1955; Duncan, 1977

2.1.4 Mineral Resources

The only known developable mineral resource on the site is gravel. Steilacoom gravel is typically a source of sizable gravel deposits. Similar deposits in Pierce County have been developed.

No mineral resources other than gravel occur on the site. The deposits of peat in some of the marshes are not large enough to make development of them worthwhile. Only the Nisqually soils on the site are suitable for use as a source of topsoil, and these soils occur only on small areas in the southwest corner of the site.

2.1.5 Geologic Hazards

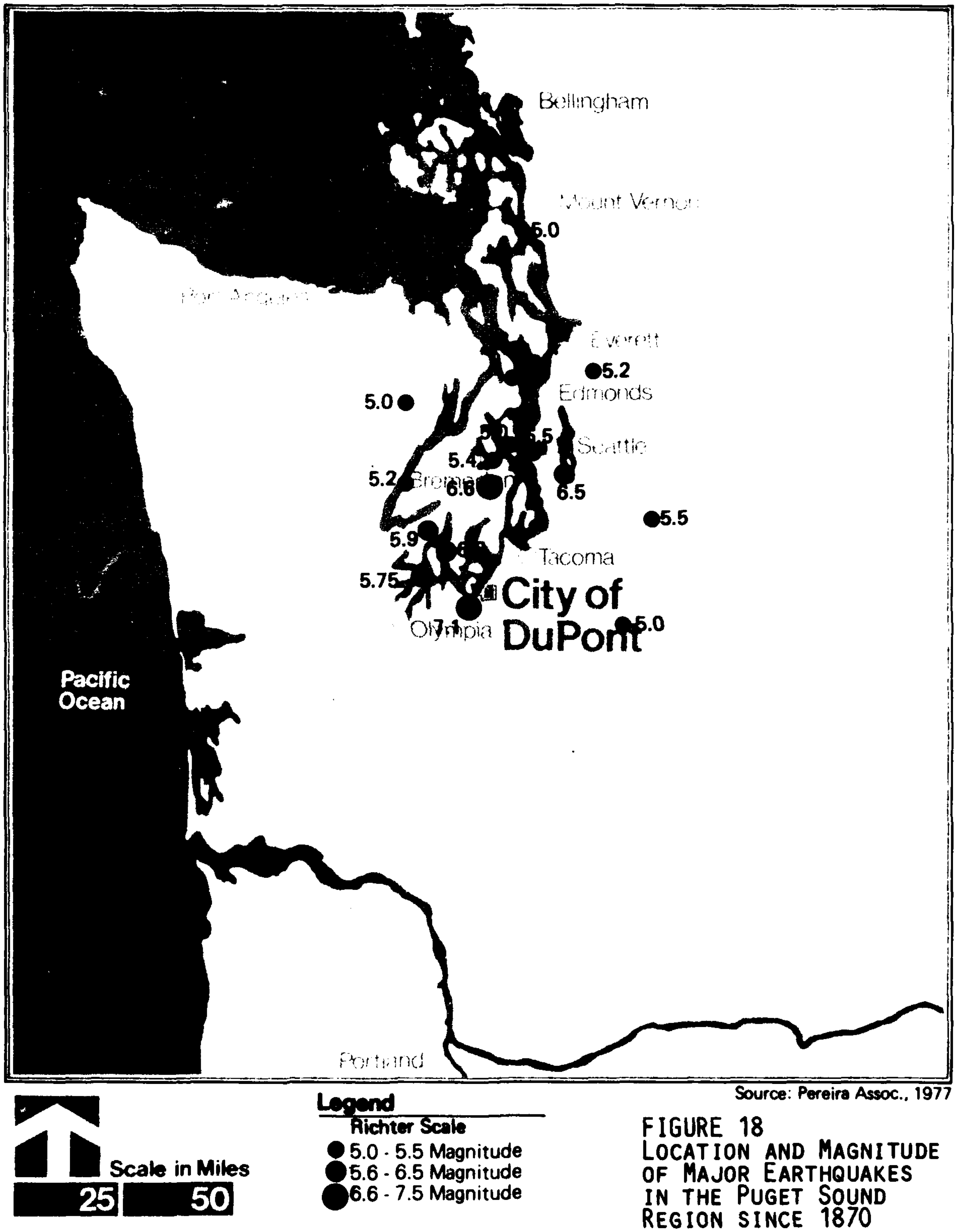
2.1.5.1 Erosion. Significant potential for erosion is present in the bed of Sequalitchew Creek, on the steep banks along Sequalitchew Creek, and on the bluff, particularly where vegetative cover is lacking.

2.1.5.2 Slope Failure. The only geologic unit on the site associated with significant risk of slope failure under natural conditions is Kitsap formation, which occurs along Puget Sound in the Hoffman Hill area and along a portion of Sequalitchew Creek (Figure 17). Steep slopes of Kitsap formation have a tendency to break off in large blocks, particularly in areas of groundwater seepage. A small spring is present in the old railway cut slope in the area of Kitsap soils along Sequalitchew Creek. Duncan (1977) observed a small, stabilized landslide in this area.

Cutbank stability of the soil units on the site is listed in Table 3. Comparison of this table with Figure 17 shows that most of the site, except some areas in the Hoffman Hill area, would be unsuitable for new excavated cuts.

2.1.5.3 Seismic Setting. Moderate to strong earthquakes occur in the region. Figure 18 shows the epicenters of strong-motion earthquakes since 1870. Intensity records have been used to estimate Richter magnitude of most of these events. Estimated recurrence intervals are listed in Table 4. Richter-magnitude events of 4.0 are capable of producing some damage over a small area near the epicenter. They can be expected to occur almost every year somewhere in the southern Puget Sound area. Larger events are expected to occur less frequently. Although the region is seismically active, no active faults have been identified in the area.

Of the damage-producing phenomena associated with severe earthquakes, those most likely to be important in southern Puget Sound include strong ground motion (observable shaking of the surface of the earth) and ground failure. The entire DuPont site is susceptible to the effects of strong ground motion.



Source: Pereira Assoc., 1977

FIGURE 18
LOCATION AND MAGNITUDE OF MAJOR EARTHQUAKES IN THE PUGET SOUND REGION SINCE 1870

TABLE 4

RECURRENCE INTERVALS FOR EARTHQUAKES
IN THE SOUTH PUGET SOUND REGION

Richter Magnitude	Recurrence Interval (Years)
3.5-4.0	.25-.5
4.1-4.5	.5-2
4.6-5.0	2-5
5.1-5.5	5-10
5.6-6.0	10-30
6.1-6.5	30-60
6.6-7.0	60-100
7.1+	150+

Source: University of Washington - Department of Geological Sciences, 1971.

Two types of ground failure are likely: induced slope failure and differential settlement. Induced slope failure is a hazard mainly along the bluff bordering Puget Sound and along the Sequalitchew Creek ravine. The greatest potential for differential settlement occurs in loose, water-saturated sediments, such as those identified offshore by Hart & Crowser (1976). Sediments south and west of the DuPont wharf would probably undergo liquefaction (act like quicksand) in earthquakes expected to occur every 50 years on the average. The potential for liquefaction of the upper 5 to 10 feet of sediment elsewhere in the vicinity of the dock is not considered to constitute a significant hazard (Hart & Crowser, 1976). The coarse gravels covering most of the site are much less subject to ground failure.

2.1.6 Accretion/Avulsion

Neither accretion, the buildup of land by deposition of waterborne materials, nor avulsion, the sudden removal of soil by a change in a river's course or by a flood, are important processes on the DuPont site. Sediment carried by Sequalitchew Creek is deposited near the mouth, slowly building up the small delta. This is the only known accretion on the DuPont site.

Data on sediment transport along the beach indicate that the groin is eroding and that sediment movement in the vicinity of the DuPont wharf is northward along the east shore of the Nisqually Reach (CH2M Hill, 1978).

There has been little change in the bathymetry in the area over the past 100 years. Diver observations noted little evidence of scour or sediment deposition around the present dock. Typical on-shore buildup was observed during the winter storm season. Summer erosion was equaled by winter accretion, yielding little or no net change. Although data collected indicate that the groin is eroding, more summer data was available than winter data.

2.2 CLIMATE

This section briefly discusses the regional climate. Temperature and precipitation data for the site are given. Data on wind speed and atmospheric stability on the site, needed to evaluate dispersion of any pollutant emissions, are also summarized here. More detailed data on the meteorology of the DuPont site are provided by Ward (1978).

The region has a typical marine climate with cool, dry summers and moist, comparatively mild winters. The climate is strongly influenced by Puget Sound, the Pacific Ocean, and the Olympic and Cascade mountain ranges. The ocean moderates the temperature, and the mountain ranges affect the regional wind flow, precipitation and temperature patterns.

During winter, frequent low-pressure systems migrate across the region causing frequent cloudiness, rain, and strong southwest winds. During summer, the land surfaces become warmer than the ocean water and a large, persistent high-pressure system often develops over the eastern Pacific Ocean.

Temperature and precipitation data for Tacoma (Table C-1, Appendix C) indicate the seasonal patterns of the region. Recent precipitation patterns have deviated substantially from the normal pattern. Data for 1976 is provided for comparison. Annual precipitation averages 40 inches, falling principally during autumn and winter.

Aerometric data sampling stations are shown in Figure C-1 (Appendix C). The instruments at each site and the parameters monitored are listed in Table C-2. Available data (Ward, 1978) indicate that the predominant wind flows are from the SW (27 percent of the time) and the NNE (10 percent). Groundlevel (33 feet) winds are low. Forty percent of the wind speeds measured were calm (less than 2 feet/second).

Atmospheric stability, as indicated by the difference in temperature between the 33- and 197-foot levels, is typically rated on the Pasquill/Gifford scale. The stability at DuPont from July 1977 through March 1978 were most frequently E or F, indicating very stable atmospheric conditions generally associated with ground-level inversions. These conditions begin in the evening and last into the following day. Midday conditions were typically Class D. A Class B (unstable) condition was observed only once in the period for which data are available.

The very stable atmospheric conditions increase wind shear (differences in wind speed between 33 and 197 feet). Wind shear at DuPont is much greater than is typical of rural wooded areas. Wind direction change with height appears to be counterclockwise (i.e., if wind flow is from the north at the ground, it will acquire a westerly component with height).

2.3 AIR QUALITY

This section first discusses the regulatory requirements affecting the site. Next, emission sources and air quality in the region, including at DuPont and on the site itself are described. More detailed information on these subjects is provided by Ward (1978).

Air quality in the region near DuPont is good. Only occasional violations of primary or secondary standards for carbon monoxide and ozone occur. The largest emission source near the site is Interstate 5. On-site monitoring indicated that levels of pollutants other than oxidants and non-methane hydrocarbons are well within standards.

2.3.1 Regulatory Requirements

The Clean Air Act of 1970 established National Ambient Air Quality Standards for six pollutants. The act requires states to develop implementation plans for attainment and maintenance of these standards and authorizes states to adopt more stringent standards. Within the state, regional air pollution control agencies, which can adopt standards appropriate to their region, have been established. The agency with authority in the Puget Sound region is the Puget Sound Air Pollution Control Authority (PSAPCA). In any region, the most stringent of all applicable standards apply. Table C-3 (Appendix C) summarizes the applicable air quality standards for the DuPont site.

The 1977 Clean Air Amendments impose additional restrictions on development that might affect air quality. Regions classified as not yet having attained the mandated air quality standards will be subject to restriction of additional pollutant-generating development. Other regions will be placed in one of three Prevention of Significant Deterioration (PSD) classes that specify the maximum increases above baseline values allowed in the region.

Table C-4 (Appendix C) lists the PSD increments. Class I is intended to preserve air quality of national parks, wilderness areas, and other areas with excellent air quality at present. Class II is intended to allow some industrial growth. The DuPont site is Class II pursuant to Section 162 (b) of the amendment.

2.3.2 Regional Air Quality

Major sources of pollutants in the Puget Sound area include many industrial point sources in Seattle and Tacoma and automobile and home heating emissions throughout the urbanized areas. No major point-source emissions near DuPont were identified by the Environmental Protection Agency. The largest area source of pollutants is probably Interstate 5. Other possible emission sources in the DuPont vicinity include fugitive dust from vehicular traffic on local unpaved roads, and Fort Lewis military operations.

Data available for the region near DuPont indicate that the geometric mean concentration of suspended particulates dropped from 40 ug/m^3 in 1974 to approximately 25 ug/m^3 in 1975. Air quality standards for ozone are occasionally violated at Lakewood (Ward, 1978).

2.3.3 DuPont Site Air Quality

On-site monitoring of air quality parameters was initiated in July 1977. More information on aeromatic data collection is provided in Appendix C.

Data collected between July 1977 and March 1978 are summarized in Ward (1978). The levels of most pollutants were well below the applicable standards during this period. Average baseline levels during this period were:

- 27 ug/m^3 particulate
- 3 ug/m^3 SO_2
- 400 ug/m^3 CO
- 78 ug/m^3 NMHC
- 13 ug/m^3 NO_2

Levels of non-methane hydrocarbons (NMHC) exceeded standards numerous times at both the Pacific Northwest Bell Repeater Station adjacent to Interstate 5 and at a more remote station (Fort Nisqually). Sources of hydrocarbons measured at the repeater station include the interstate, a busy exchange, the main arterial through DuPont, and a busy gas station. Sources at the more remote site are unknown. These violations do not contribute to the high oxidant levels measured at Lakewood. For more detailed information see Ward (1978).

2.4 ODOR

Present activities on the DuPont site do not produce any objectionable odors. Historically, however, strong odors were emitted from the DuPont plant. Ammonia emissions occurred at least once a week while explosives were being manufactured.

2.5 WATER

This topic has been divided into five sections. The first two discuss (1) movement and (2) quality of on-site freshwater resources, including groundwater. The next two sections discuss the same subjects with respect to adjacent marine waters. The fifth section discusses floodplains in the vicinity. Baseline information dealing with water quality of the DuPont site and Nisqually Reach was taken from studies conducted by Thut et al. (1978), except where otherwise noted. Marine hydrology discussions are based largely on the baseline studies performed by CH_2M Hill (1978).

2.5.1 Freshwater Hydrology

Freshwater resources on the site include Sequalitchew Creek, Old Fort Lake, Edmond Marsh and groundwater (Figure 19).

Surface and groundwater on the site are closely linked. Groundwater seepage is an important source of inflow to the lake, ponds, and stream. Groundwater moves toward the Sound. A deep aquifer is fed by recharge off

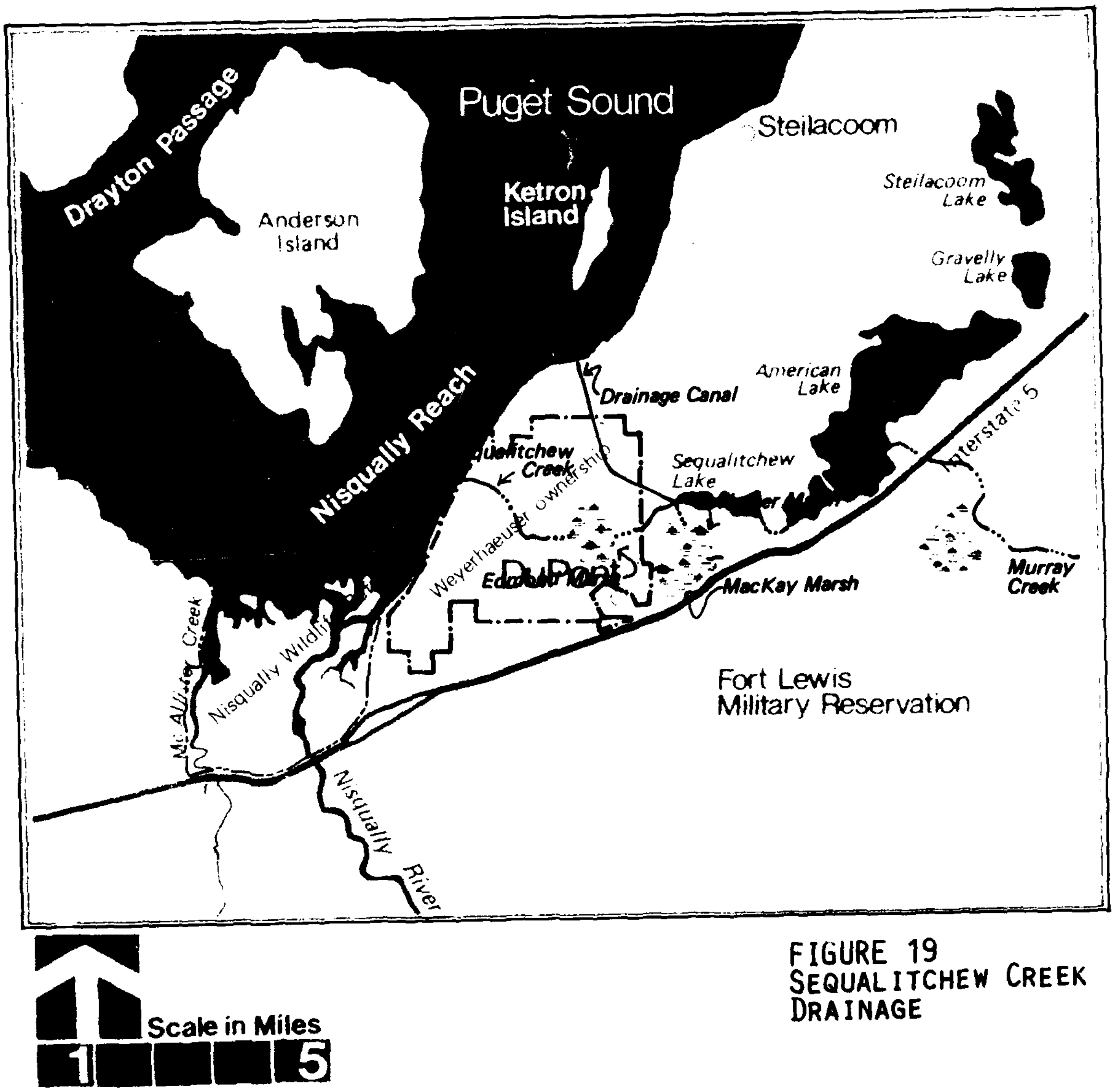


FIGURE 19
SEQUALITCHEW CREEK
DRAINAGE

the site. Streamflow in Sequalitchew Creek is typically low in the summer and occasionally it dries up completely.

Figure 19 shows the watershed of Sequalitchew Creek. The creek is fed by overflows from Sequalitchew Lake, which is fed by overflow from American Lake. Therefore, flows in Sequalitchew Creek are affected by withdrawals from American Lake for irrigation and by withdrawal of water for Fort Lewis from Sequalitchew Springs. These withdrawals affect the water level in Sequalitchew Lake.

West of Edmond Marsh, the stream traverses a flat upland area with sparse vegetation. In the lower 1.5 miles, the creek descends from an elevation of 200 feet through a steep-sided ravine with dense vegetation to a point south of the DuPont wharf, where it enters the Sound. Little natural estuary is present in this area (Williams, 1975).

A bypass canal from Hamer Marsh and the marshy area near the outlet of Sequalitchew Lake drains directly into the Sound about 1.5 miles north of the existing wharf. When water levels in the lake and marshes build up, excess water is released into this canal by means of an overflow section (Williams, 1975). Hence, flooding does not occur in the lower section of the creek.

The soils on much of the site are so porous that infiltration of rainfall is rapid. Little surface runoff occurs (Walters, 1968).

Sequalitchew Creek receives little surface runoff from the DuPont site; however, data on nitrate levels (See section on Freshwater Quality) indicate that flow in the lower section of the stream is probably augmented by groundwater recharged by local precipitation. A small spring [flow less than one cubic foot per second (cfs)] also enters the stream in the ravine.

Streamflow records for Sequalitchew Creek are limited to a few scattered dates between 1942 and 1949 and continuous monitoring from April 1977 to March 1978, an unusually dry period. The early data are of questionable value in establishing baseline flow information because of subsequent construction of the bypass channel. Summer flows have been reported to drop to zero when the level of Sequalitchew Lake drops below the outlet or when beaver dams in culverts in the marsh areas block flows. (Streamflow dropped to zero between September 12 and 17, 1977.)

Analysis of the continuous streamflow data revealed that during the extreme low-flow period, flow peaked near noon and fell to a minimum near 5 p.m. The variation is probably due to withdrawal of water from the upstream lakes or to increased transpiration of riparian plants.

Low flow continued into November. After a heavy rainfall in late November, streamflow increased rapidly from 0.2 to 0.13 m^3/s. Maximum flows (0.447 m^3/s) were observed in December. High, relatively steady flows were observed from January to March 1978, when monitoring was discontinued. During this period, mean flows measured in the range of 0.196 to 0.413 m^3/s. The March 30, 1978, streamflow (0.362 m^3/s) was over ten times greater than that of a year earlier (Thut et al., 1978).

Old Fort Lake, located in a nearly circular kettle (depression in the surface) in gently rolling terrain south of Sequalitchew Creek (Figure 12), is a small, shallow lake (Thut et al., 1978). The lake has neither surface inlets nor outlets. Presumably depth fluctuates with groundwater level.

The groundwater in central Pierce County is derived almost entirely from precipitation within the area. The highly permeable gravel overlying the region permits maximum infiltration of precipitation. Fifty to sixty percent of the precipitation falling in the region percolates into the underlying aquifer (Griffin, 1962).

Movement within the region is to the north or northwest. Natural discharge occurs through springs, many of which are located along the margin of the upland adjacent to Puget Sound. Some of these springs are located near sea level and have flows that fluctuate with tidal levels. Such a spring is recorded adjacent to the site near the northern boundary (Walters, 1968) (Figure 20).

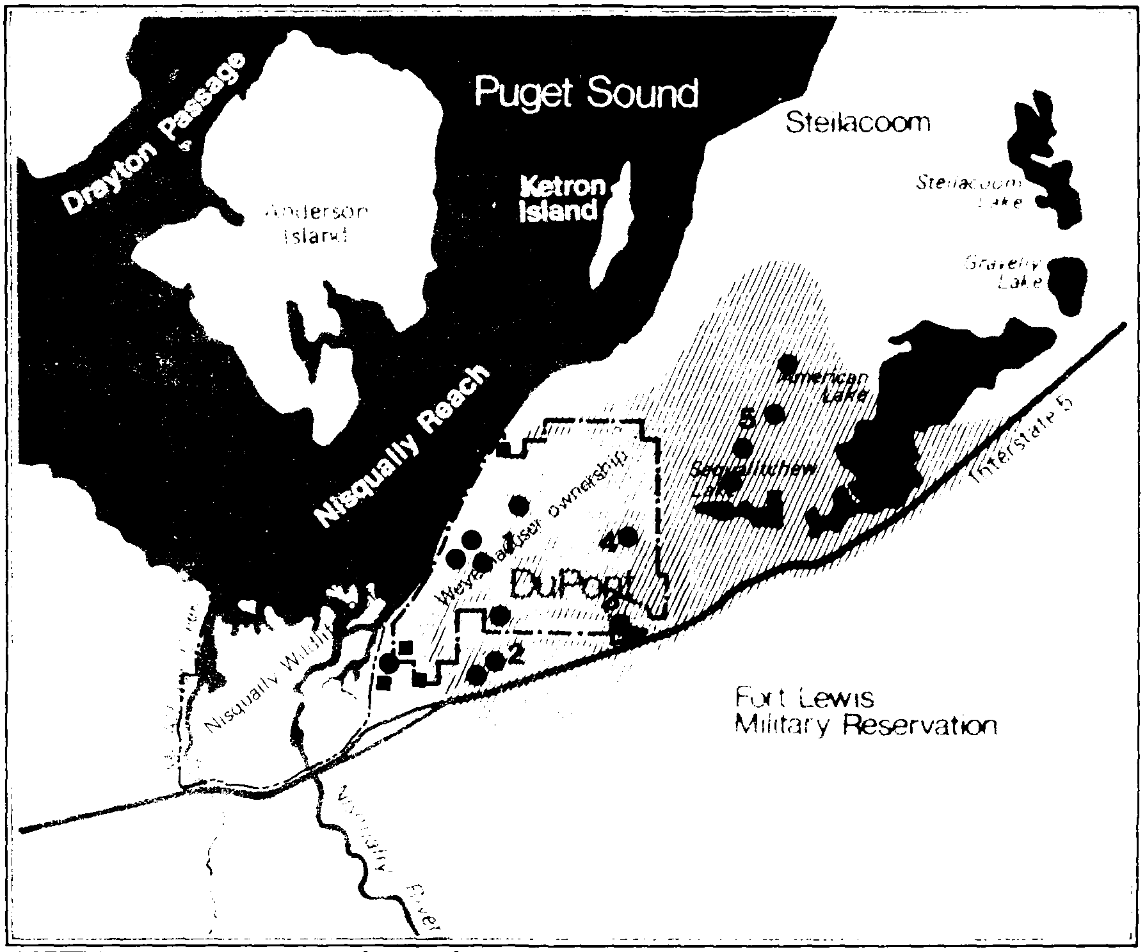
Data in the State of Washington Water Supply Bulletin (Walters, 1968) suggest the presence of three aquifers. An evaluation of the data on existing wells within the Sequalitchew groundwater basin (Figure 20) indicates the presence of two aquifer systems: a shallow aquifer, which has a head (pressure) of 200 feet above sea level and is recharged by local precipitation, and a deeper aquifer system, which has a head of 100 feet above sea level and is recharged by leakage from the surface aquifer and by water flowing from recharge areas to the east (Noble, 1975).

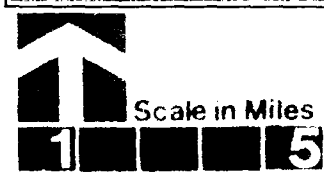
Aquifer recharge over the entire 3200-acre site probably averages 4,900 to 5,900 acre-feet per year. Noble (1975) concluded that the sustainable yield (assuming continuous pumping) would probably be about 10 million gallons per day (mgd) if both aquifers were developed. Numerous wells would be required.

2.5.2 Freshwater Quality

Both surfacewater and groundwater quality in the DuPont vicinity are generally excellent. Groundwater quality in southwestern Pierce County is excellent, except where saltwater intrusion occurs. Principal ions are typically calcium and bicarbonate. Hardness of water from wells in the DuPont-Fort Lewis region ranges from 26 to 97 parts per million (ppm) as calcium carbonate. These values are low to moderate for groundwater. Groundwater quality on the site is excellent, except that some wells near the DuPont Company industrial area have been contaminated by chemical spills (Thut et al., 1978). These wells have also shown signs of saltwater intrusion in the past. Surfacewater quality is also generally excellent, except for high nitrate levels in Sequalitchew Creek.

Data collected in 1977 from several wells on-site (Appendix D, Table D-2) show high nitrate and sulfate levels in the DuPont Company wells (Wells 1 and 3, Figure 21). The nitrate levels exceed those recommended by the EPA for domestic water supplies (10 ppm) and may be due to long-term contamination from the sodium nitrate used for many years by the DuPont Company. In





Legend

Groundwater Basin Boundary
■ Spring
● Well (Static Water Level)

1. DuPont Company Plant Wells (10')*
2. Fort Lewis Golf Course Well (91')*
3. DuPont Town Wells (210')*
4. Magazine Well (190')*
5. Fort Lewis Wells (100')*

*Elevation of water table above sea level

Source Noble, 1975

FIGURE 20
SEQUALITCHEW
GROUNDWATER
BASIN

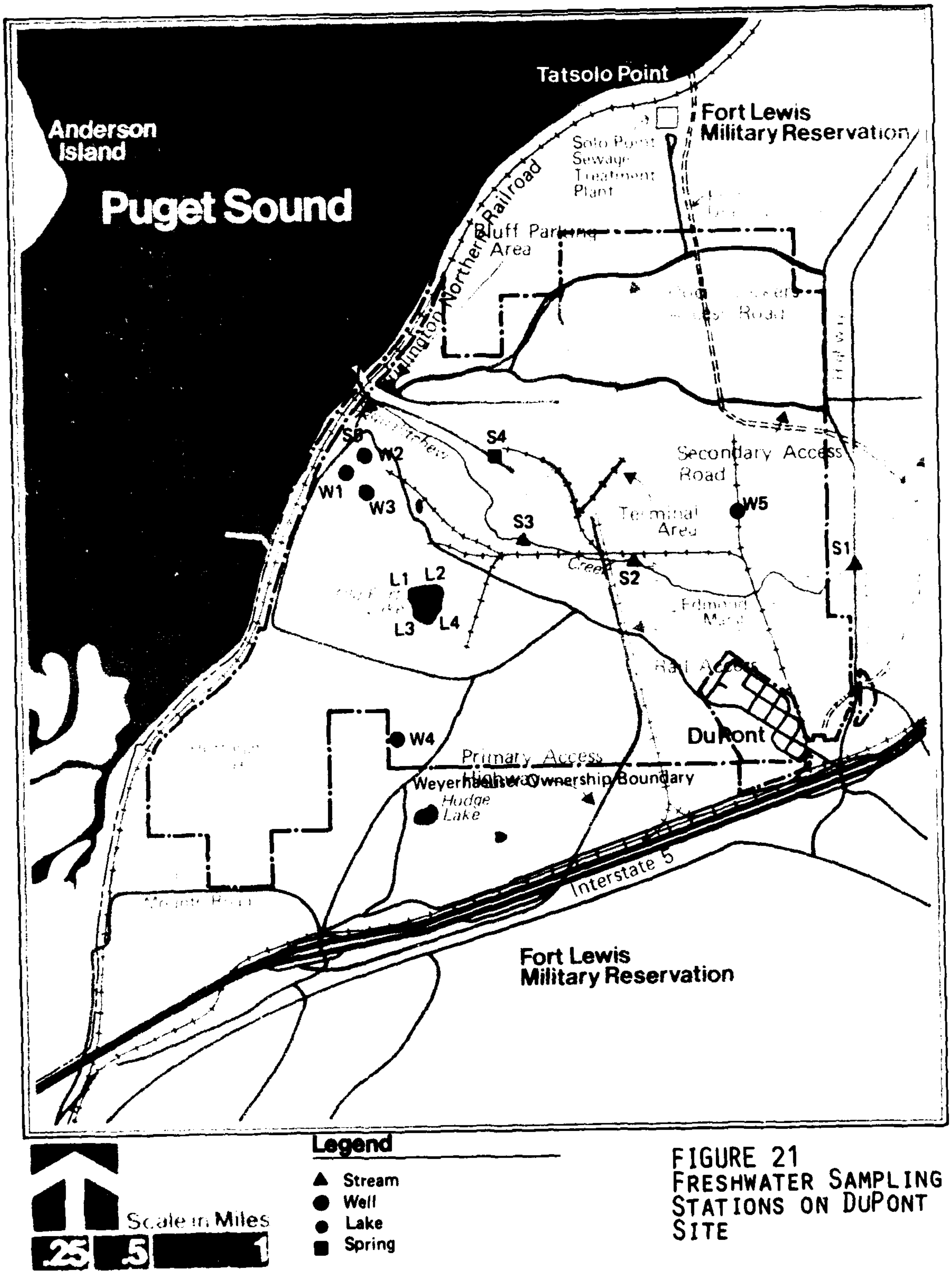


FIGURE 21
FRESHWATER SAMPLING STATIONS ON DUPONT SITE

contrast to most wellwater in the region, sulfate and nitrate, rather than bicarbonate, were the predominant anions in these wells. Alkalinity and pH were unusually low and manganese levels were higher than typical of the region. The water quality from other wells on the site is typical of the region as is that of the water issuing from the small spring along Sequalitchew Creek.

Saltwater intrusion is frequently a problem in coastal areas. This problem occurs when the hydraulic head of a freshwater aquifer is reduced (perhaps by pumping) to a magnitude lower than the head of an adjacent saltwater aquifer. Chloride concentrations exceeding 10 ppm may indicate current saltwater intrusion, contamination from sewage or industrial wastes, or presence of relict seawater in the aquifer. Chloride concentrations over 250 ppm exceed EPA standards for water for domestic use (EPA, 1976).

Walters (1971) concluded that the beginning of saltwater intrusion might be indicated in the DuPont area by chloride concentrations in the industrial wells. Well 3 (Figure 21) had a chloride concentration of 27 mg/l in 1966, compared to 112 mg/l in 1961. Well 2 showed an increase from 9 mg/l in 1961 to 15 mg/l in 1966. These wells extend from 44 feet to as much as 115 feet below sea level. Chloride concentration probably varies directly with pumpage (Walters, 1971). In 1977 chloride levels ranged from 3 to 10 ppm, well below levels indicating present intrusion. Nonetheless, the earlier data suggest intrusion could become a problem at high withdrawal rates.

Data for Sequalitchew Creek are limited to those collected in a baseline study (Thut et al., 1978) and some data collected in a one day survey by the Washington State Department of Ecology (WDE) in 1971 (Pine, 1972). The locations sampled by Thut et al. (1978) are shown in Figure 21; Stations S1 and S2 correspond to two of the sites sampled in the WDE study. During the initial period of the baseline study, Western Washington and, indeed, the entire west were at the tail end of a period of drought. Rainfall was about half of normal. Thus, the initial portion of the quality monitoring program on Sequalitchew Creek took place under conditions of unusually low flow through the end of the summer of 1977.

The most striking results of the baseline study were the very high nitrate levels observed at the downstream station (Station S5) in 1977. High nitrate levels were measured in the early portion of the study at the lower station. Station 5 concentrations ranged between 1 and 7 mg/l. As the flow in the creek increased toward the end of the study the nitrate levels at Station S5 dipped to about 1 mg/l. This was still higher than the concentrations at the upper stations, which generally remained at around 0.5 mg/l.

The dramatic increase in nitrate concentration at the lower stations, especially pronounced during periods of low flow, is probably a result of inflow of nitrate rich groundwater. As mentioned previously, samples from wells in the vicinity show high nitrate levels. During low flow periods, groundwater input is a major source of the stream water as it flows through the ravine. As described above, groundwater in the vicinity of the old DuPont munitions plant is contaminated by nitrate and has lower pH and alkalinity than other groundwater in the region.

Water temperature was monitored continuously at Stations S2 and S5. From April to June 1977, the maximum water temperature at the upper station exceeded that of the lower station. From December 1977 to March 1978, the data show the opposite trend, with warmer water downstream. This also reflects the importance of groundwater inflow in the lower portion of the stream.

Other parameters also reflect the influence of the groundwater inflow. Color is high as water leaves the upstream marsh and diminishes as the water flows downstream. Alkalinity tended to be lower downstream, and pH increased below the marshes.

Turbidity was low throughout much of the study, as no major storms occurred during March to November. Levels as high as 22 NTU were observed during heavy rainfall in winter 1977-78. Phosphorus levels were typical of the region. Oxygen levels varied predictably with the nature of the streambed. Oxygen levels were low in water leaving the marshes, while water at Stations S3 and S5 was near saturation most of the time. The relatively high concentrations of lignins are probably due to the presence of the upstream marshes. No petroleum contamination was detected.

Sequalitchew Creek has not been specifically classified by the state (WDE, 1977). Therefore, it falls in the Class A category according to WAC 173-201-070. Instances when standards for Class A streams (Appendix D, Table D-1) have been exceeded are shown in Table 5. Elevated fecal coliform bacteria levels were probably due to low flow (Thut et al., 1978).

TABLE 5

COMPARISON OF SEQUALITCHEW CREEK WATER QUALITY DATA TO STATE WATER QUALITY CRITERIA (VIOLATIONS EXPRESSED AS FRACTION OF TOTAL OBSERVATIONS)

	Station S1	Station S2	Station S3	Station S5
Bacteria*	0/8	1/8	2/10	3/11
Dissolved Oxygen	7/9	6/10	1/12	0/13
pH	3/9	3/9	1/11	1/12

*Compared to 50 fecal coliforms/100 ml figure.

Source: Thut et al., 1978

The lowest dissolved oxygen and pH values occurred at the upstream stations. Dissolved oxygen levels were below the state water quality criterion of 8 mg/l for Class A streams in seven out of nine observations at Station S1 and in six out of ten observations at Station S2 (Table 5). The magnitudes of the violations tended to be greater at S1 than S2. Dissolved oxygen concentrations at S1 ranged from 2.4 mg/l to 4.5 mg/l in observations made in the months April through November. During the period December through February, dissolved oxygen concentrations were slightly below the state criterion or exceeded it. Values of pH were slightly lower than the state water quality criterion for Class A streams (minimum pH 6.5) in three of nine observations at Stations S1 and S2. The lowest measured pH value (5.4) occurred at Station S2 during November. Both oxygen and pH violations were less frequent downstream (Figure 4).

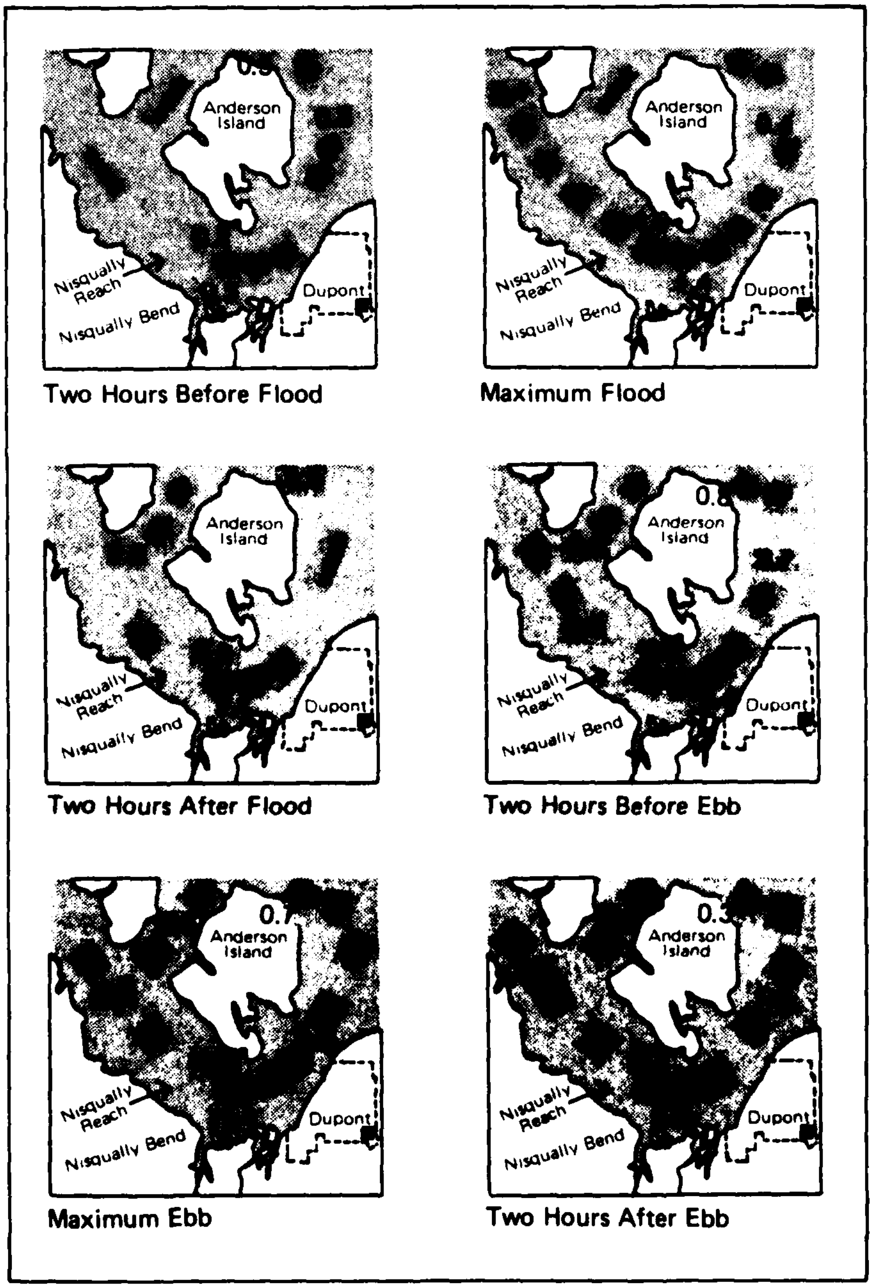
Data for Old Fort Lake (Thut et al., 1978) indicate that it is a shallow, eutrophic lake characterized by summer blue-green algal blooms. Temperature measurements at the surface and bottom of the lake revealed no stratification. Alkalinity is slightly lower and pH is slightly higher than in the area wells (except the industrial wells). Lake nutrient data show high levels of organic nitrogen and phosphorus. Feces of waterfowl that feed at the lake are probably the principal exogenous source of nutrient loading. More detailed information on freshwater quality is described by Thut et al. (1978).

2.5.3 Marine Hydrology

The Nisqually Reach of Puget Sound borders the western boundary of the site (Figure 22). Tides are the dominant factor affecting water movement throughout the study area. Tides in Puget Sound are mixed; that is, heights and durations of successive high and low waters are unequal, so that two high and two low tides of different magnitude occur at different times each day. Tides in Nisqually Reach at Sequalitchew Creek have a mean range of 13.4 feet, a diurnal range of 9.6 feet, and a mean tide level of 7.7 feet.

Tidal current patterns in Nisqually Reach are complex (Figure 22). For example, in the channel between Anderson Island and Ketron Island, ebb currents occur most of the time, reaching velocities up to 1.1 knots, whereas flood currents are usually only about 0.4 knots. Off the mouth of the Nisqually River, flood currents are more prominent occurring for about the same length of time as the ebb currents but with slightly greater velocities. For more detailed information on marine hydrology refer to the hydrological baseline studies (CH_2M Hill, 1978).

The Nisqually River provides most of the freshwater entering Nisqually Reach. Streamflow records for the Nisqually River near McKenna indicate a 27-year average flow of about 1,800 cfs. Field observations indicate that Nisqually River water flows over the denser Nisqually Reach water and is transported as a thin surface layer throughout much of the reach (CH_2M Hill, 1978).



Source: THE NISQUALLY DELTA, University of Washington Dept. of Geological Sciences, 1971

Arrows show current direction.

Time is from the Tacoma Narrows.

Velocity is in Knots.

FIGURE 22
TIDAL CURRENTS NEAR THE NISQUALLY DELTA

Waves in southern Puget Sound are generated by local winds, ocean waves do not penetrate far into the Sound. The occurrence and strength of storm-waves and length of fetches in the area determine wave characteristics. Maximum fetch lengths in the area are approximately 15 miles between the narrows and the Nisqually Delta and 13 miles between the center of Case Inlet and the Delta. Winds greater than 15 knots seldom continue long enough to create waves higher than four feet.

Water exchange in the Nisqually Reach is accomplished by several mechanisms. Freshwater inflow from the local streams and rivers is less prominent than the tidal outflow and upwelling. Dye studies conducted using the University of Washington's physical model of Puget Sound indicate that there is a net tidal outflow through the Reach in the surface layer of 0.12 knots. This indicates that the replacement time of the surface water is 8 days, assuming there is only minor refluxing of the surface water.

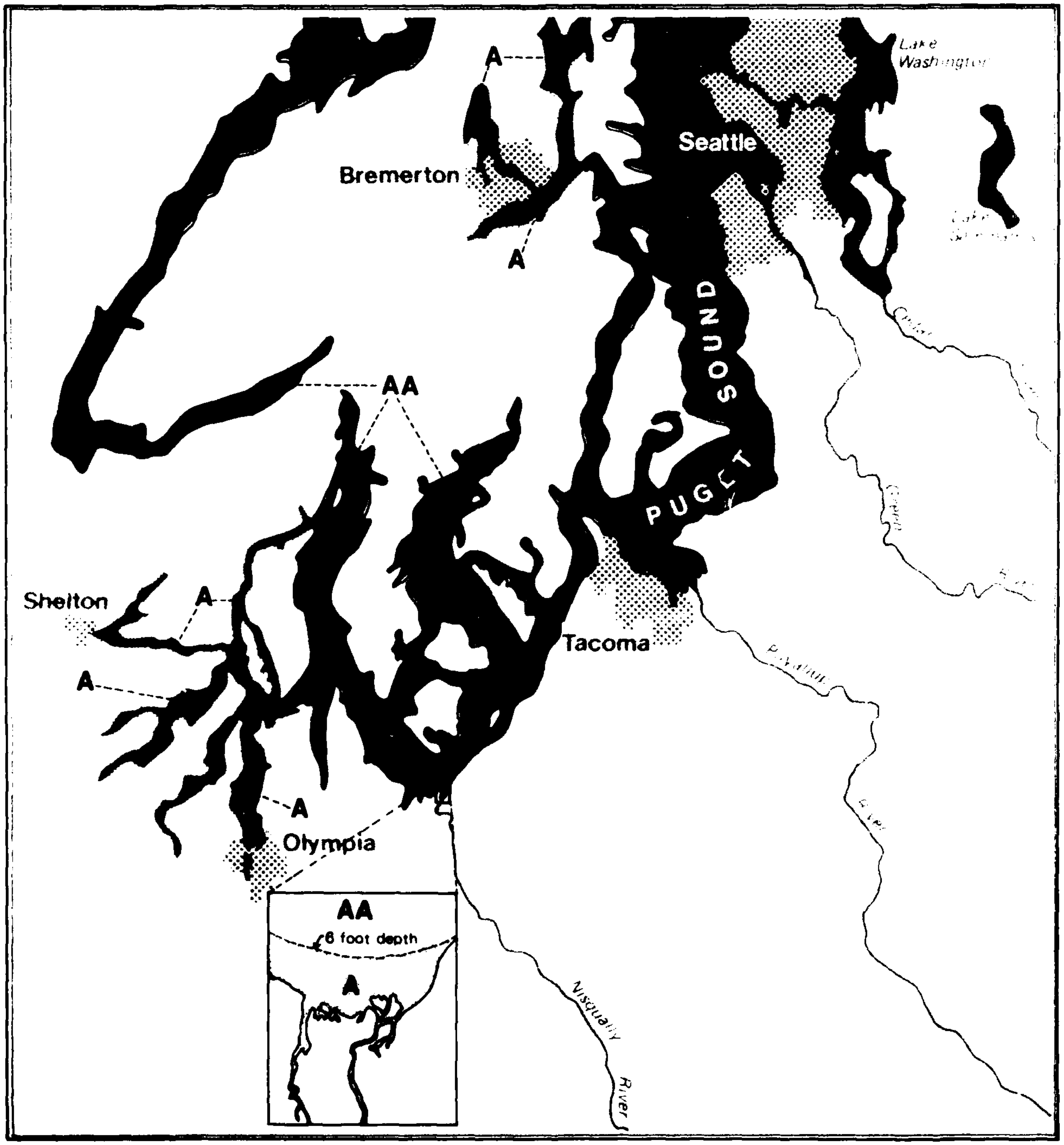
A third mechanism for exchange of water within Puget Sound occurs due to coastal upwelling of deep, dense seawater which penetrates from the open ocean into bottom waters of the Sound. Friebertshauser and Duxbury (1972) estimated the replacement time for several basins within Puget Sound. For that portion of the Sound south of the Tacoma narrows (including the study area) an average replacement time of 56 days was calculated. This replacement time includes all of the many inlets in the southern Sound. Due to their location and configuration many of these inlets flush more slowly than the Nisqually Reach. Flushing in the Reach is faster because it is an open channel, has stronger tidal currents and is close to the Narrows. Therefore, the flushing time in the Nisqually Reach will be some undetermined amount less than 56 days.

2.5.4 Marine Water Quality

Marine water quality adjacent to the site is excellent. The State of Washington has designated the waters of Nisqually Reach Class AA marine waters (Figures 23 and 24). The estuarine area at the mouth of the Nisqually River and the lower portion of the river itself have been designated Class A. (Criteria for each class are presented in Appendix D.)

The only significant point source discharge in the Reach is the Fort Lewis sewage treatment plant, with an outfall at Tatsolo Point (Thut et al., 1978). No point sources are known in the estuarine area of the Nisqually Delta.

Both historical data and data collected in baseline studies (Thut et al, 1978) provide insight into variation of water quality parameters in Nisqually Reach with depth and season. Slight temperature stratification in the waters of the Reach begins in April or May, and persists until September or October. Surface waters have temperatures as much as 1 to 2°C higher than middepth (17-60 meters deep depending on the station) and bottom waters (33-120 meters deep depending on the station) during this period. Typical winter surface temperatures range from 6° to 10°C, whereas typical summer surface temperatures range from 11° to as high as 17° C.



Scale in Miles

4 8 16

Legend

Class AA Exceeds requirements for substantially all uses

Class A Meets or exceeds requirements for substantially all uses

** Commencement Bay Classifications include A, B, and C

FIGURE 23
WATER CLASSIFICATIONS IN LOWER PUGET SOUND

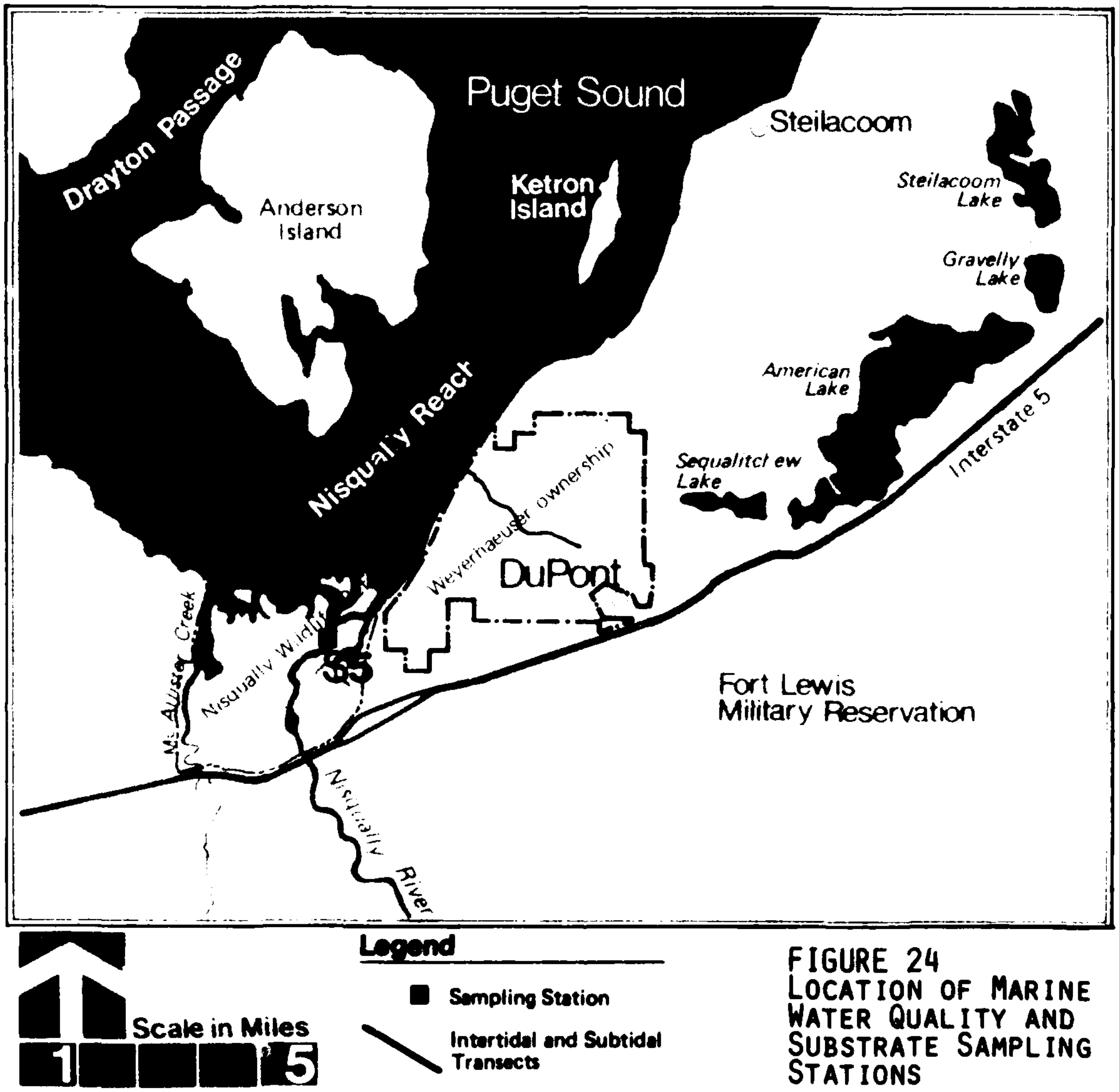


FIGURE 24
LOCATION OF MARINE WATER QUALITY AND SUBSTRATE SAMPLING STATIONS

Dissolved oxygen concentrations (DO) generally decrease slightly with depth, especially in late spring and summer when photosynthetic activity in the surface layer is high. The mean difference between DO concentrations of the surface and deeper waters was 0.7 mg/l (Thut et al., 1978). Concentrations of nitrate and orthophosphate are highest in the Nisqually Reach during the winter, apparently due to elevated nutrient levels and flows in the Nisqually River at that time (Thut et al., 1978).

Lower concentrations of both nitrate and orthophosphate occur in surface waters, especially during the summer months. This presumably is due to uptake of these nutrients by phytoplankton occurring in the surface waters, where light for photosynthesis is available (Thut et al., 1978).

Available data show that standards for dissolved oxygen and temperature are exceeded both in the Reach and in the Nisqually River estuary (Station 5). In the estuary this apparently results when Nisqually River water and receding tidal water flow slowly over the mud flats. High biological activity in the mud flats may cause decreases in DO, and shallow water depth over the mudflats allows increased solar heating of the sediments. Low DO at middepth and bottom sampling points in the Reach is due to the relatively low oxygen content of oceanic water, the major source of exchange or replacement water in Puget Sound. Dissolved oxygen concentrations were frequently encountered in the 6-7 mg/l range between August and October. Violations of standards documented in both historical and recent data are listed in Table 6. Temperatures at all measured depths in the Nisqually Reach consistently exceed 13°C (the state standard) in the summer.

TABLE 6

COMPARISON OF WATER QUALITY DATA TO
STATE WATER QUALITY STANDARDS

Violations as Proportion of Total Observations

	Historical Data			
	Station S1	Station S2	Station S3	Station S4
Temperature	0/19	10/159	22/418	27/1220
Dissolved Oxygen	2/21	57/159	110/407	304/1231
pH	0/28	---	0/54	0/39

	May 1977 to April 1978			
	Station S1	Station S2	Station S3	Station S4
Bacteria*	0/12	0/12	1/12	0/12
Dissolved Oxygen	6/36	4/36	2/35	3/31
pH	3/33	0/33	2/33	0/31

*Compared to log mean of 14 fecal coliforms/100 ml figure.

Source: Thut et al., 1978

Recreational boats using the area lose small amounts of oil and grease to the water; in general, this source is diffuse. Results of baseline studies were highly variable, but highest levels were observed near a popular sport fishing area at Lyle Point, Anderson Island. Concentrations of oil and grease were generally below .01 mg/l (as resolved alkanes).

The sediments along five intertidal/subtidal transects (Figure 24) were analyzed for heavy metals and petroleum hydrocarbons at mean high water (MHW), mean lower low water (MLLW), and -15 meter (MLLW) contour depths. Concentrations for arsenic, cadmium, copper, mercury, zinc, and most notably lead were lower in the sediments of the Delta (Transects 4 and 5, Table D-3) than in sediments tested along Transects 1, 2, and 3 (Figure 24). According to Thut et al., (1978), this lower background concentration of trace metals in the Delta sediments is probably a result of the deposition of relatively "clean" sediment from the river. This deposition would tend to dilute the concentration of trace metals present in the Delta sediments relative to sediments sampled along Transects 1, 2, and 3, which would be less subject to deposition of sediments from the Nisqually River (Thut et al., 1978). Transects 2 and 3, in the vicinity of the DuPont dock, generally have a slightly higher heavy metal content. This is probably due in part to the effects of the historic shipping activity. Except for mercury and lead, the metal concentrations tended to be lower in the intertidal sediments than in the deeper sediments, probably due to the higher concentration of fine particles, such as clay, in the deeper sediments, which have a greater surface area per volume. The greater surface area provides more area for attachment of metal particles, and thus would be expected to yield greater metal concentrations.

Polynuclear aromatic (petroleum) hydrocarbons (PAH) and alkanes (paraffins) were measured in sediments along the DuPont shoreline. In samples collected at -15 meters near the existing dock (Thut et al., 1978) and in more recent samples at MHW and MLLW (URS, 1980), alkanes were higher in concentration along Transect 1, north of the dock, than in other areas. This suggests the possibility that some low level contamination has occurred in the vicinity of the dock, likely due to past activities, although, due to the rapid circulation of the Sound in general and this reach in particular, PAH and alkane sources could be distant from the site.

2.5.5 Floods

Periodic flooding occurs along the Nisqually River. The area that would be likely inundated by a discharge of about 42,000 cubic feet per second (cfs) is shown in Figure 25. Such a discharge occurred in 1933 and is estimated to have a recurrence interval greater than once every 100 years (USGS, Flood Profiles, 1974). The DuPont site is outside of this floodplain.

The Nisqually Wildlife Refuge protected by dikes, is shown in Figure 25. On December 4, 1975, a flood washed out a portion of the dike bordering the Nisqually River. Before repair of the dike in June 1977, approximately 565 acres of land within the refuge were continuously inundated and 100 acres were periodically inundated by brackish water (U.S. Dept. of the Interior, 1977).

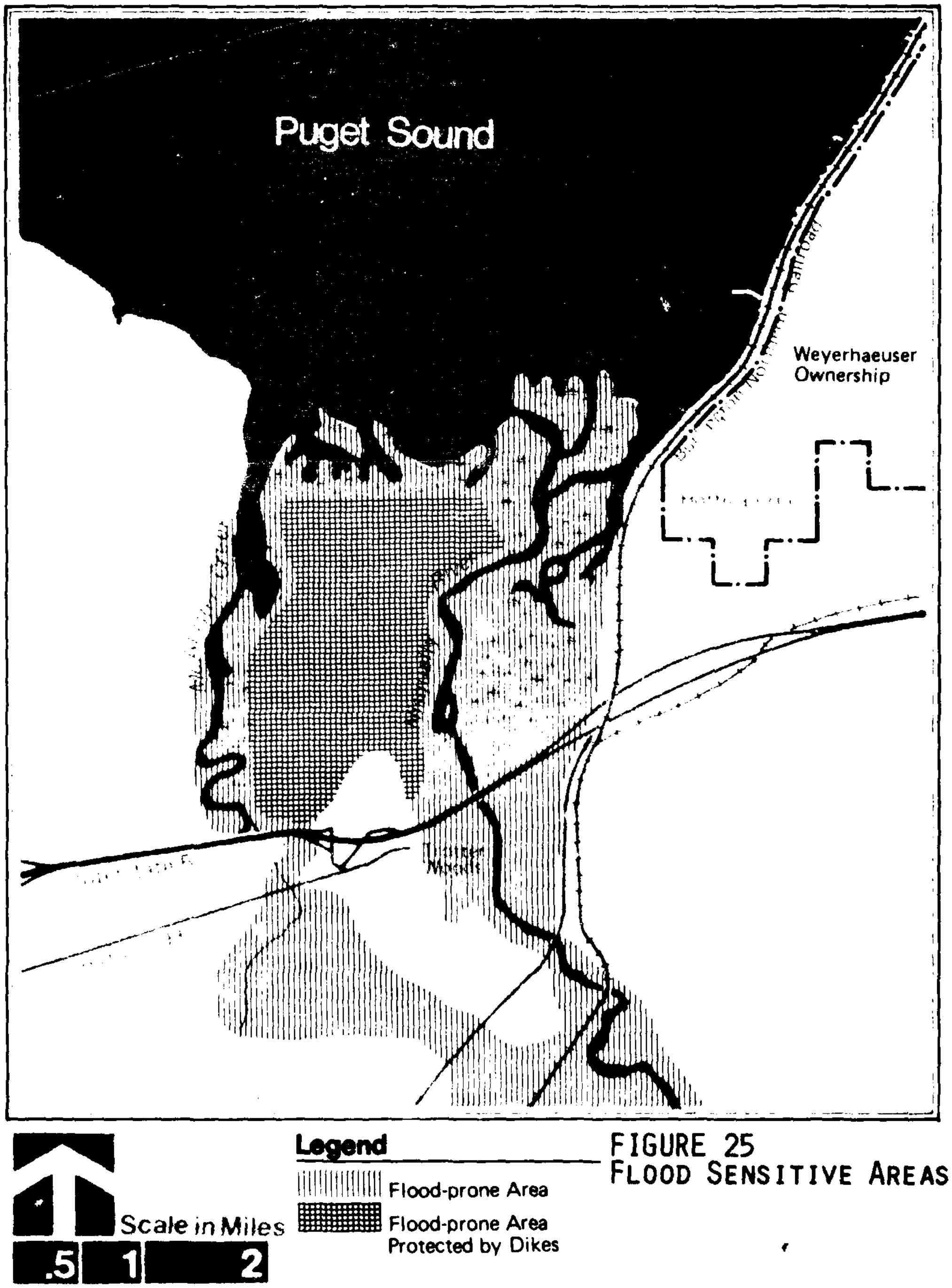


FIGURE 25
FLOOD SENSITIVE AREAS

Source: USGS Water-Resources Investigations 42-73, 1974.
Flood Profiles and Inundated Areas Along The Lower Nisqually River, Wash.

In accordance with Executive Order 11988, Flood Plain Management, the Corps of Engineers has evaluated the proposed project and determined that it is not located in a flood plain. Therefore, the provisions in EO 11988 do not apply to the proposed action.

2.6 TERRESTRIAL BIOLOGY

The following discussion describes the terrestrial biology of the DuPont site, a portion of which would be directly affected by the proposed project. Because of the concern over possible impacts on portions of the adjacent Nisqually Delta, the terrestrial biology of that area is also discussed here. The information in this section is based primarily on baseline studies by Melchiors and Motobu (1978) and Klotz et al. (1978) dealing with the terrestrial biology of the DuPont site and Nisqually Delta, respectively, unless otherwise indicated. For greater detail these reports should be consulted. These reports can be examined at the Seattle District Office, Corps of Engineers.

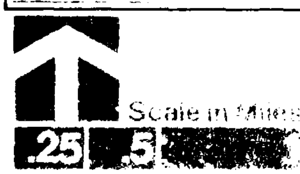
2.6.1 DuPont Site-Flora/Habitats

The DuPont site lies in the Puget Sound area of the wet coniferous forest region (Franklin and Dyrness, 1973). Although this region is generally characterized by climax forests of the western hemlock-western red cedar type, the dominant forest type on the DuPont site and the surrounding vicinity is dry coniferous forest dominated by Douglas fir. This regional anomaly is due mainly to the gravelly, excessively drained soils in southwestern Pierce County. The site has low-productivity potential as commercial forest land.

Flora on large portions of the DuPont site have been considerably altered by human activity over the past 145 years. Presently, the site consists of a composite of second-growth Douglas fir forest, mixed forest, oak savannah, prairie, pasture, and freshwater marsh, with interspersed urban and industrial areas (Melchiors and Motobu, 1978).

The flora of the DuPont site is mapped in Figure 26. The area covered by each of the vegetation types is presented in Table 7. Each of these habitats and the associated vegetation types is described briefly in this section.

Most of the site could potentially support closed Douglas fir forests, which have 75 to 100 percent canopy closure by Douglas fir. Older tree stands (90-100 years) have sparse understory shrubs; younger stands have denser understories dominated by salal. The open Douglas fir forest is characterized by less than 75 percent canopy coverage and a dense understory in which Scot's broom, Pacific blackberry, common swordfern, and bracken are abundant. The Douglas fir successional scrub vegetation type is characterized by sparsely distributed Douglas fir trees growing in thick underbrush. The diversity and density of shrubs and herbaceous plants is greater in this association than in the other vegetation types.



Legend

Douglas Fir Forest

	Successional Shrub	G	Prairie
	Open Forest	H	Fresh Marsh
	Closed Forest	I	Bog

Other

D	Mixed Forest	Cleared Area
E	Oak Savannah	Cleared Area
F	Pasture	
K	Salt Marsh	

FIGURE 26
VEGETATION/HABITAT TYPES ON THE DUPONT SITE

TABLE 7

ACREAGE ESTIMATES AND PERCENT OF TOTAL ACREAGE
FOR VEGETATION TYPES AT THE DUPONT SITE
(Melchiors and Motobu, 1978)

Vegetation Type	Acres	Percent of Total Acreage
Douglas fir Closed Forest	1,349	42
Douglas fir Open Forest	516	16
Douglas fir Successional Shrub	435	14
Mixed Forest	138	4
Oak Savannah	131	4
Prairie	198	6
Pasture	94	3
Fresh Marsh	116	4
Peat Bog	15	<1
Old Fort Lake	22	<1
Beach and Breakwater	T*	<1
Cleared Area	183	6
TOTALS	3,197	100

*Trace, not mapped on Figure 26.

Two other woodland habitat types are present on the site--mixed forest and oak savannah. Mixed forest stands occur in moist areas and are dominated by western hemlock and red alder, with lesser amounts of bigleaf maple and western red cedar. The dense shrub understory is dominated by Pacific blackberry. In the oak savannah, a rapidly decreasing vegetative type in western Washington, the predominant tree is Garry oak. Scot's broom, common snowberry, hairy cats-ear, and various grasses are common understory plants.

Five vegetation types on the site are not dominated by trees: prairie, pasture, open space, freshwater marsh, and peat bog. The latter two are discussed in Section 2.8.10. The prairie on the site is an open expanse with Scot's broom and various grasses as its main vegetation. Pasture areas are essentially grass meadows that have had a history of grazing.

The cleared-area habitat type is defined as land significantly altered by humans from its natural state. It includes the military landfill and firing range, the Village of DuPont, and the office and industrial area of the DuPont Company.

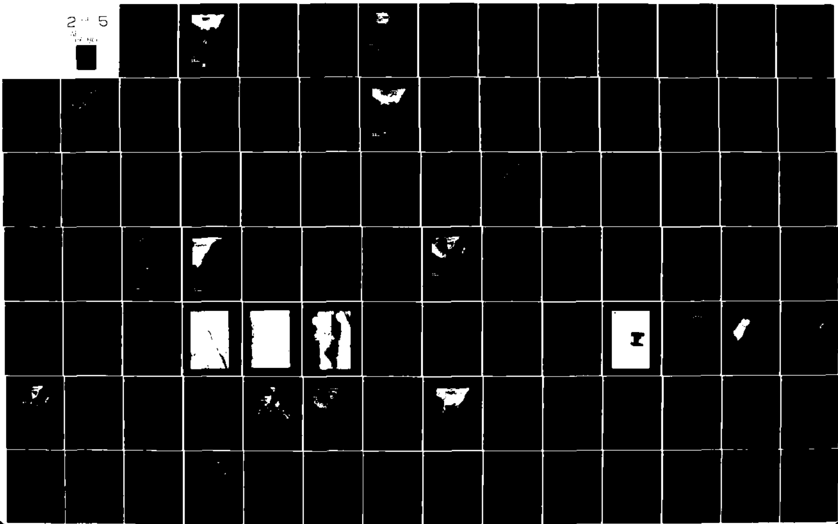
2.6.2 Nisqually Delta Flora/Habitats

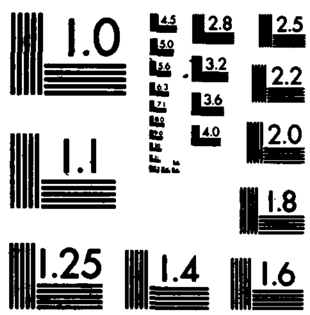
The Nisqually Delta is one of the most extensive (3,768 acres) and relatively undisturbed estuarine areas in the Puget Sound. Among the habitats found in the delta are mudflats, small freshwater and brackish marshes, diked meadows, woodland, and an extensive undisturbed salt marsh, unique in southern Puget Sound (Klotz et al., 1978). The waters of Nisqually Reach, Nisqually River, McAllister Creek, and flooded diked areas provide additional habitat.

AD-A116 180 URS CO SEATTLE WA F/G 13/2
WEYERHAEUSER EXPORT FACILITY AT DUPONT. VOLUME I.(U)
MAY 82

UNCLASSIFIED NL

2 of 5




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0

Klotz et al. (1978) conducted a yearlong baseline study in the delta that included quantitative surveys of vegetation, birds, and small mammals in five principal habitats (salt marsh, dike, freshwater marsh, meadow, and woodland), and quantitative surveillance of plants, birds, mammals, reptiles and amphibians in the entire delta study area. Vegetation types found in the Nisqually Delta are shown in Figure 27. The area covered by each is presented in Table 8.

TABLE 8

ACREAGE ESTIMATES AND PERCENT OF TOTAL ACREAGE FOR MAJOR TERRESTRIAL VEGETATION/HABITAT TYPES AT THE NISQUALLY DELTA (Klotz et al., 1978)

Vegetation/Habitat Types	Acres	Percent of Total Terrestrial Acreage
Salt Marsh	711	52
Freshwater Marsh	36	3
Meadow	460	34
Woodland	86	6
Dike	8	<1
Other Terrestrial Habitats (Disturbed Areas and Groves)	54	4

A significant portion of the terrestrial area (665 acres) was inundated by tidal and river water after a break occurred in the dike along the Nisqually River in December 1975. Existing plant and animal communities were greatly altered by the combined effects of salt water and inundation. The dike break was repaired in June 1977. Drier habitats present within diked portions of the delta and along the river include meadow, woodland, and the dikes themselves. Descriptions of the vegetation found in these areas are available in the baseline study conducted by Klotz et al. (1978).

2.6.3 Birds - DuPont Site

Melchiors and Motobu (1978) conducted baseline observations of birds in terrestrial, freshwater, and marine habitats of the DuPont site. The following discussion is based on their study, unless otherwise noted.

Melchiors and Motobu (1978) observed 137 species of birds at the DuPont site. These included a variety of passerine species (song birds), waterfowl, game birds, and raptors. The most abundant land birds are generally common in similar habitat throughout Western Washington (Anon., 1975). Water birds, game birds, and raptors observed on the site are also commonly seen in the surrounding area, especially in the Nisqually Delta.

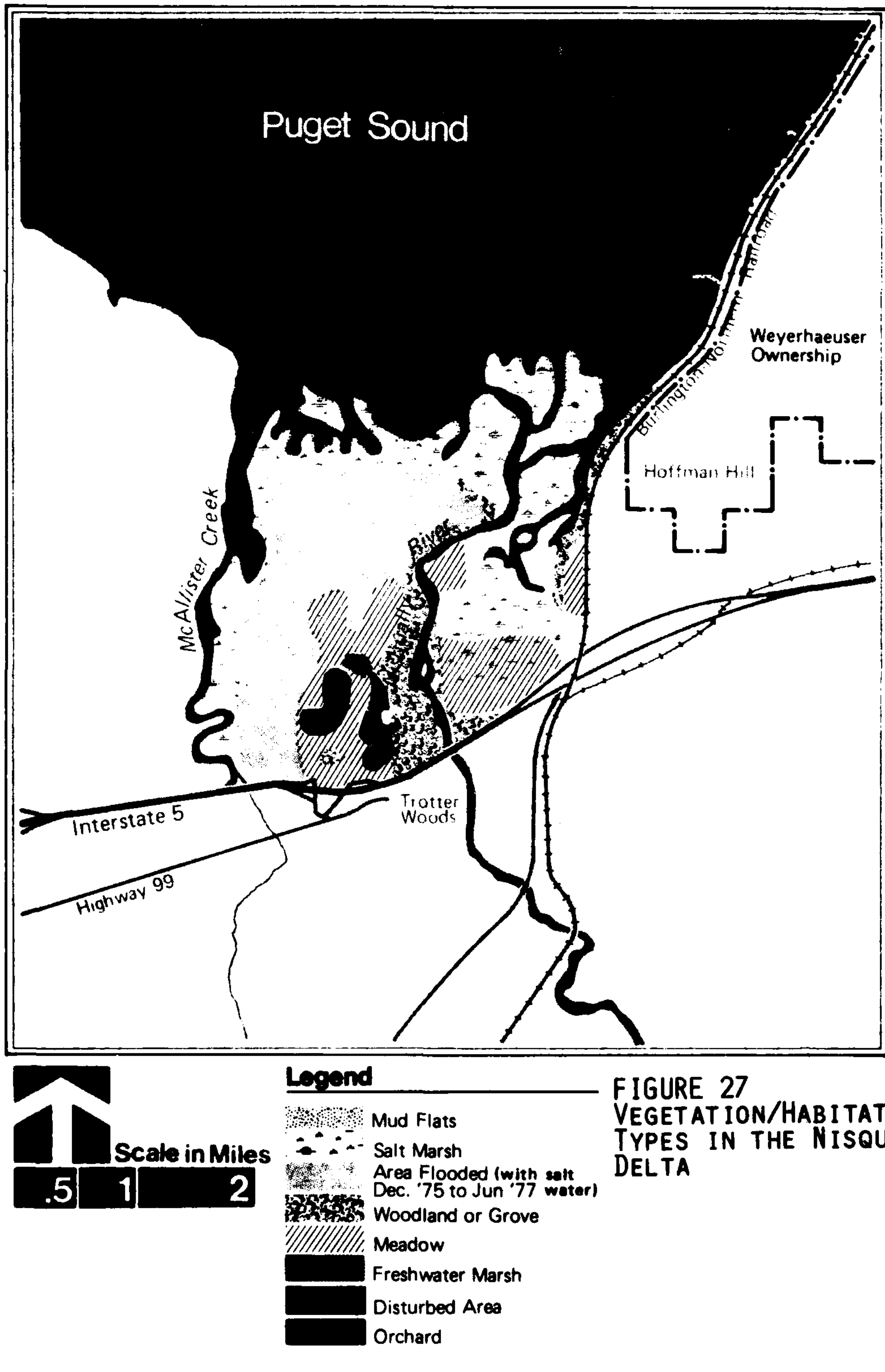


FIGURE 27
VEGETATION/HABITAT TYPES IN THE NISQUALLY DELTA

2.6.3.1 Land Birds. In general, a different group of birds occurs in each of the habitats on the site according to Melchiors and Motobu (1978). Table F-1 (Appendix F) compares the ten most abundant species of each terrestrial habitat. Total numbers, numbers of species, and species composition vary with the season. The importance and use of habitats by birds changes with season, availability of food and nest sites, water level, and other factors. The open conifer forest supported the greatest density of birds, whereas the mixed forest had the greatest species diversity.

2.6.3.2 Water Birds. In general, Melchiors and Motobu (1978) found that use of the DuPont site by water birds was low throughout the year relative to the use of the Nisqually Delta and adjacent Nisqually Reach. Relatively greater use of the DuPont shoreline by waterbirds probably occurs during periods of very low tides when greater intertidal areas are exposed. Melchiors and Motobu (1978) observed relatively large numbers of waterbirds along the DuPont shoreline during a -0.1 low tide. Although not observed by Melchiors and Motobu, Klotz et al. (1978) observed a raft of 221 common mergansers floating over flooded mudflats southwest of the DuPont wharf. Habitats at the DuPont site used by waterbirds include Puget Sound, Old Fort Lake, the small salt marsh near the mouth of Sequalitchew Creek, and the military landfill located in the northeast corner of the site (Figure 5). Gulls and crows were the most common birds observed at the landfill. Birds seen on Puget Sound mainly included gulls, alcids, waterfowl, grebes, crows, loons and numerous marine species. Old Fort Lake is used primarily by waterfowl in the fall, winter, and spring and by shorebirds and swallows in summer. Goldeneye and mallards have been observed in the salt marsh.

Little use of the DuPont site by nesting water birds was observed in the spring and summer of 1977, possibly because of the drought. Water levels in marshes on the site were significantly lower than tyically found. Total numbers of waterbirds were generally low in the spring and summer of 1977; however, greater numbers would be expected in the fall and winter. During spring and summer field studies, Melchiors and Motobu (1978) noted frequent movement of birds beteen DuPont and the Nisqually Delta. They suggested that these movements probably occur to a much greater extent when large gatherings of migrant birds are present in the Delta area during fall and spring migrations. Use of the cobble beach and intertidal zone between the breakwater and the existing DuPont wharf by feeding waterbirds was observed to be low relative to the more intensive use of exposed mudflats south of the breakwater (Melchiors and Motobu, 1978). Surveys were conducted biweekly. If surveys had been conducted weekly during April and September (the most important periods for water bird migration), it is possible that greater numbers would have been observed. No survey was conducted along the shoreline northeast of the existing dock.

2.6.3.3 Birds of Special Interest. Birds of prey (raptors) and game birds are usually of special interest to the public. Ten species of raptors were observed during field work. Only the Cooper's and red-tailed hawks (*Accipiter cooperii* and *Buteo jamaicensis*) and the great horned owl (*Bubo virginianus*) were seen frequently. One pair of redtailed hawks were known to

nest in the Sequalitchew Creek canyon. Inspection of the nest in November 1978 revealed some damage to the nest due to loss of one of the support limbs. Nonetheless, it could probably be rebuilt and reused.

The DuPont site serves as a refuge for game birds, since hunting is not allowed on the site (hunting is permitted in the Delta area). Twenty percent of the bird species observed in the baseline studies were game birds. This includes four species of upland game birds (blue grouse, Dendragapus obscurus; ruffed grouse, Bonasa umbellus; California quail, Lophortyx californicus; and ring-necked pheasant, Phasianus colchicus) and twenty-four species of migratory game birds, which include the mallard (Anas platyrhynchos), green-winged teal (Anas crecca), American wigeon (Anas americana), and the northern shoveler (Anas clypeata).

2.6.4 Birds - Nisqually Delta

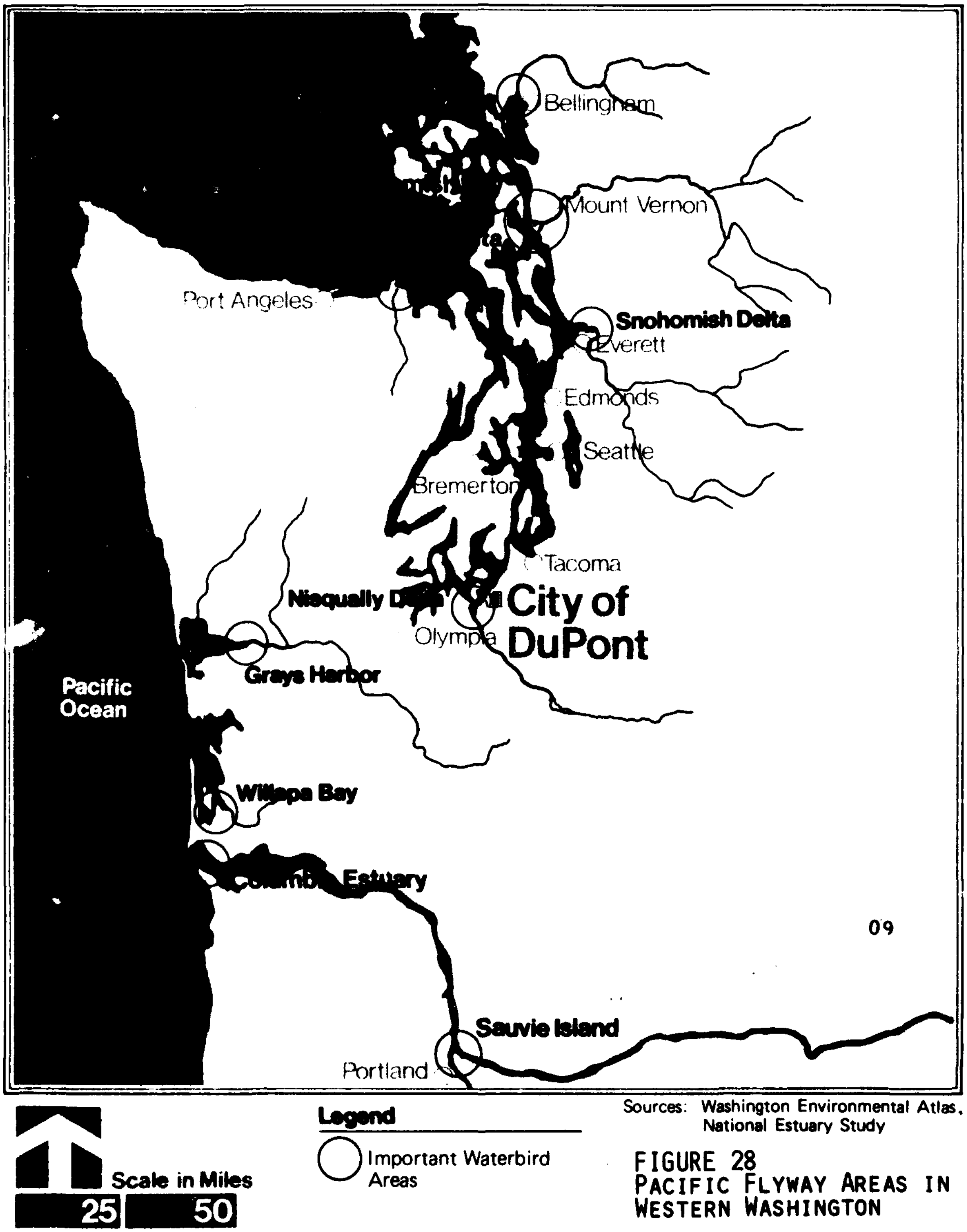
The Nisqually Delta is the major non-coastal nesting and feeding area for migrating waterfowl and shorebirds between Skagit Flats and the Columbia River (Figure 28). The importance of the delta as a part of the Pacific Flyway was recognized by its designation as a national wildlife refuge. Although some birds winter in the delta, others use the area for only a short time during migration. Nevertheless, residents, wintering, and migrant birds are vitally dependent upon the area and its rich food sources.

During migration birds expend large amounts of energy and require food, rest, and protection from predators. Because migration is a time of increased vulnerability for bird populations, the quality of habitat they find along the flyway strongly influences overall species populations (Anon., 1975).

The mudflats and salt marsh habitats are a major reason for the importance of the delta to waterbirds. Waterbirds are more abundant on the Nisqually Delta and adjacent Nisqually Reach than on the DuPont site. They are often seen in the area where the Reach and river currents meet, on exposed and flooded mudflats, and scattered over open water of the Reach. Grebes, scaups, scoters, gulls and other water birds are frequently observed in the Nisqually Reach and intertidal areas.

Bird species composition observed in Nisqually Reach varies with the season. Birds observed regularly during the spring are red-necked grebe (Podiceps grisegena), horned grebe (Podiceps auritus), western grebe (Aechmophorus accidentalis), scaup (Aythya spp.), surf scoter (Melanitta perspicillata), Bonaparte's gull (Larus philadelphia), common murre (Uria aalge), pigeon guillemot (Cepphus columba), and rhinoceros auklet (Cerorhinca monocerata). Scaups are most common at the border of the reach and the flooded mudflats, where rafts of approximately 100 are often observed. Common murres, pigeon guillemots, glaucous winged (Larus glauscescens) and Bonaparte's gulls and lesser numbers of rhinoceros auklets are also present on the reach during the summer.

During fall and winter, a larger number of indivudals and more species of birds are present on the reach. Common loons (Gavia immer), western grebes, white-winged scoters (Melanitta deglandi), and gulls are regularly



Sources: Washington Environmental Atlas, National Estuary Study

FIGURE 28
PACIFIC FLYWAY AREAS IN WESTERN WASHINGTON

observed in fall and winter. Western grebes are occasionally observed diving and swimming in groups as large as 400. Diving ducks regularly observed during fall and winter are greater scaup (Aythya marila), lesser scaup (Aythya affinis), common goldeneye (Bucephala clangula), bufflehead (Bucephala albeola), and white-winged and surf scoters.

Intertidal mudflats deposited by the Nisqually River and McAllister Creek are important habitats, particularly during the spring and fall migrations, when several thousand waterfowl, shorebirds, wading birds and gulls depend on the mudflats. Great blue herons (Ardea herodia) feed on these mudflats throughout the year, as do white-winged scoters, killdeer (Claradrius vociferus), gulls, and belted kingfishers (Megaceryle alcyon). Rafts of up to 221 common mergansers (Mergus merganser) have been seen over flooded mudflats throughout July and August (Klotz et al., 1978). Migrating shorebirds, including flocks of up to three thousand dunlins (Calidris alpina), feed on the mudflats in the spring. Waterfowl using the habitat in highest numbers during the spring are black brant (Branta nigricans), green-winged teal, American wigeon, scaup, and whitewinged scoter.

The fall 1977 migration of waterfowl began during the last two weeks of August when increased numbers of mallard, pintail (Anas acuta), and American wigeon were observed. During the fall and winter of that year large numbers of loons, grebes, cormorants, waterfowl and shorebirds were seen. The American wigeon was the predominant waterfowl species. The highest number of wigeon was recorded on October 6, 1977, when 8060 were seen on the exposed and flooded mudflats.

Waterbirds observed on the Nisqually River and McAllister Creek vary in species composition and abundance according to season and periods of the tidal cycles. These areas are particularly important for feeding and resting during spring and fall migrations. Great blue herons, marsh hawks (Circus cyaneus), and belted kingfishers are present in the salt marsh during all seasons.

Large numbers of birds are seen along the dike where the numerous trees, shrubs, and thickets provide feeding, nesting, and roosting habitat. Several species, including rough-winged swallows (Stelgidopteryx ruficollis), belted kingfishers, mallards, and killdeer use the dike and nearby area for nesting. Many raptors, including barn owls (Tyto alba), ospreys (Pandion haliaetus), sharp-shinned hawks (Accipiter striatus), merlins (Falco columbarius), and American kestrels (Falco sparverius) were observed hunting and roosting along the dike. The freshwater marsh habitat was used by many bird species for breeding, resting and feeding.

The meadows provide habitat for passerine species (songbirds) as well as hunting areas for raptors. During the spring and summer, savannah sparrows (Passerculus sandwichensis) are abundant, nesting in tall grasses.

The woodland communities are inhabited by a number of passerines, woodpeckers, and raptors. Dense areas of bigleaf maple provide nesting habitat for several species, as do the moister areas along sloughs.

2.6.5 Mammals - DuPont Site

According to the baseline study conducted by Melchiors and Motobu (1978), twenty-nine species of mammals are known to use the DuPont site. Most of these are resident herbivores common to the region. The thirteen species of large and medium-sized mammals inhabiting the DuPont site are listed in Table F-2 (Appendix F). Of these, the blacktail deer (Odocoileus hemionus) is the most important game species. Western gray squirrels (Sciurus griseus), whose principal habitat, oak savannah, is becoming decreasingly abundant in Western Washington, were observed on the site (Melchiors and Motobu, 1978). The oak savannah habitat at DuPont may support one of the largest populations of this western gray squirrels in the state. Another mammal of special interest that occurs on the DuPont site, the masked shrew (Borex cinereus), inhabits moist, forested areas like the Sequalitchew ravine. A summary of habitat preference and feeding behavior of the small mammals of the DuPont site is shown in Table F-3 (Appendix F).

Two species of marine mammals were observed near the DuPont site in April, May, and June of 1977: harbor seals (Phoca vitulina), frequently observed in Nisqually Reach between the DuPont wharf and breakwater, and a juvenile gray whale (Eschrichtius glaucus), observed from the wharf on April 28, 1977 (Melchiors and Motobu, 1978).

2.6.6 Mammals - Nisqually Delta

The following discussion of mammals of the Nisqually Delta is based on the study conducted by Klotz et al., 1978. Mammals species observed at the DuPont site are also present in the Nisqually Delta. Harbor seals are regularly seen on flooded mudflats and adjacent waters. The number of seals sighted between April 1977 and February 1978 ranged from one to 17. Larger groups were seen from September through November. Harbor seal sightings in the delta have increased from a low in the late 1960s. Thus, it is possible that a reproducing colony may be establishing itself in the area.

Killer whales (Orcinus orca) have been infrequently seen in the Nisqually Reach. River otters (Lutra canadensis) were sighted along both the Nisqually River and McAllister Creek. Muskrat (Andatra zibethica) and mink (Mustela vision) were occasionally sighted on inner sloughs adjacent to the dike. The skull of a mountain beaver (Castor canadensis), not recently reported in this area, was found in the woodland habitat. Coyotes (Canis latrans) have been observed using a variety of habitats on the delta.

2.6.7 Amphibians and Reptiles

The following discussion of amphibians and reptiles is based on the baseline study of the Nisqually Delta conducted by Klotz et al., 1978. Amphibians and reptiles observed on the site are those common in similar habitats in the region. The northern rough-skinned newt (Taricha granulosa granulosa) is abundant on the DuPont site and also uses the woodland habitat in the delta. The Pacific treefrog (Hyla regilla) and the red-legged frog (Rana aurora aurora) are the most abundant and widespread amphibians on the DuPont site. They have also been observed in the delta woodland and freshwater marsh habitats. Bullfrogs (Rana catesbeiana) always remain in or near permanent water, and they have been heard infrequently at the site.

Two lizard species, the northern alligator (Gerrhonotus coeruleus principis) and northwestern fence lizard (Sceloporus occidentalis occidentalis), have frequently been observed on the bluff leading to the DuPont wharf. The snake most commonly observed on the DuPont site is the red-sided garter snake (Thamnophis sirtalis pickeringi), which is most abundant in dry marsh areas. Garter snakes have also been reported in the delta woodland and meadow habitats.

2.6.8 Endangered Species

Eight animals with endangered status occur, or may occur, in Western Washington (U.S. Dept. of the Interior, 1976). None is expected to inhabit the DuPont site, but some might occur as accidentals or rarities. The northern bald eagle (Haliaeetus leucocephalus), classified as threatened in Washington State, has been observed on the site.

The endangered species that occur in Western Washington include the brown pelican (Pelicanus occidentalis), the Aleutian Canada goose (Branta canadensis leucopareia), the American peregrine falcon (Falco peregrinus anatum), the Columbia white-tailed deer (Odocoileus virginianus leucurus), the finback whale (Balaenoptera borealis), the humpback whale (Megaptera novaengliae), and the gray whale. Neither the brown pelican nor the Aleutian Canada goose have been sighted in Nisqually Reach. The migration route of the Aleutian Canada goose between the Aleutian Islands and California is unknown. Peregrine falcons occur in the Puget Sound basin and have been observed in the Nisqually Refuge. According to the Fish and Wildlife Service (FWS), both subspecies, the endangered American peregrine and Peale's peregrine, which is not on the endangered list, probably occur in the area. The critical range of the Columbia white-tailed deer is along the Columbia River. They are not expected to occur in the DuPont area (Anon, 1975).

The only endangered animals likely to occur near DuPont are the gray whale and bald eagle. Gray whales have been sighted in southern Puget Sound on several occasions in past years; a juvenile gray whale was observed near the DuPont wharf in April, 1977 (Klotz et al., 1978). Coordination by the Seattle District Corps of Engineers with the National Marine Fisheries Service (NMFS) resulted in the biological opinion that endangered marine species would not likely be affected by the proposed project (see letter in Appendix E).

The Seattle District Corps of Engineers requested a list from the U.S. Fish and Wildlife Service of proposed and listed endangered and threatened species that potentially occur on the site. The Fish and Wildlife Service (FWS) provided the list in accordance with Section 7(c) of the Endangered Species Act of 1973, as amended, identifying the bald eagle as a listed species and the white-top aster (Aster curtus) as proposed for listing. Since the time that the FWS identified the white-top aster as a candidate species for listing, it has been withdrawn. It is, however, listed as threatened in Washington by the Washington Natural Heritage Program (WNHP, 1981).

As required by Section 7(a)(2) of the Endangered Species Act of 1973, biological assessments were performed on these species. The assessments included:

1. Results of the comprehensive survey of the area undertaken to identify the listed species,

2. Results of studies undertaken to determine the impacts on the identified species,

3. Consideration of cumulative effects on the species or its critical habitat,

4. Difficulties encountered in obtaining data and completing the studies,

5. Conclusions including recommendations for further studies.

The following two paragraphs concerning the bald eagle and the white-top aster (*Aster curtus*) are extracted from these assessments included as Appendix E.

Bald eagles, listed as threatened in Washington State, have been observed on the DuPont site. Although no active or inactive nests are known to exist on the site at the present time, bald eagles have nested near Old Fort Lake as recently as 1975. The snag in which the nest was located fell in 1977. Bald eagles currently nest on Anderson Island and feed in the Nisqually Delta. Since bald eagles tend to return to nesting areas that they used in the past, it is possible that the site may be used again. Bald eagles have been sighted flying over the site and probably use the site for perching on an irregular basis (Appendix E).

The white-top aster occurs in scotch broom prairie habitats on the site. Ten colonies of the plant were found, with a total of at least 15,000 individuals. Colonies were also identified on the Fort Lewis Military Reservation and at nine locations in Thurston County (Appendix E).

2.7 FRESHWATER BIOLOGY

Three freshwater habitats occur on or near the DuPont site and are thus potentially subject to impacts from the proposed project. These habitats include Sequalitchew Creek, Old Fort Lake, and the Nisqually River. Because only Sequalitchew Creek would be likely to be affected, the following discussion will emphasize the biology of that creek. The following discussion is based on Thut et al. (1978), unless otherwise indicated. More detailed information on the Sequalitchew Creek and Old Fort Lake habitats is available in reports conducted in 1977-1978 (Thut et al., 1978; Fresh et al., 1978).

2.7.1 Sequalitchew Creek - Habitat

The biotic habitats of Sequalitchew Creek between Sequalitchew Lake and Puget Sound are varied. The watershed is described above in Freshwater Hydrology. The habitat in Edmond Marsh may be characterized as a slowly flowing creek with muddy organic substrate. West of Edmond Marsh, long pool areas are interspersed with short riffle sections. Creek substrate is small gravel mixed with mud and sand. In the lower 1.5 miles where Sequalitchew Creek flows through a steep-sided ravine, descending over 200 feet in elevation, the habitat is that of well-washed riffle areas with gravel substrate.

Recorded streamflow in Sequalitchew Creek ranged from 0 to 20 cubic feet per second (cfs). Flows during the summer have dropped to zero in the past (including the summer of 1977); however, some water generally remains in the stream in most years (Thut et al., 1978).

Several physical, chemical, and biological factors affect the integrity of the Creek's habitats. Benthic invertebrates are influenced by current velocity, temperature, substrate, and availability of suitable shelter. Plant growth is affected primarily by sunlight and available nutrients and secondarily by water temperature, chemical characteristics of the water, and the scouring effects of flow.

Probably the most important single factor affecting Sequalitchew Creek habitat is that it occasionally becomes dry. This reduces the populations of stream animals since only small pools remain as habitat (Hynes, 1972). In Sequalitchew Creek, Thut et al. (1978) reported a reduction of 84 to 89 percent of the total number of invertebrates per unit area from June 6 to September 19, 1977. Streamflows for these dates were 3.32 cfs and 0.11 cfs for June 6 and September 19, respectively. The summer streamflow was low because of unusually dry weather during the previous winter and spring. When water flow in Sequalitchew Creek is sufficient, water quality is generally good (Thut et al., 1978).

2.7.2 Sequalitchew Creek - Flora

Williams et al. (1975) describes the creek as having heavy streambank cover of deciduous trees and brush along its entire length. Tree species include big leaf maple, alder, and willows. Blackberry vines are common in some areas. Salmonberry, thimbleberry, and devils club grasses are also common riparian species. Thut et al. (1978) observed heavier growths of vascular plants and algae in the upland creek area than in the marsh and canyon creek areas. A small salt marsh occurs near the mouth of Sequalitchew Creek upland from the Burlington Northern tracks (described in Section 2.8.10).

2.7.3 Sequalitchew Creek - Fauna

The following discussion of Sequalitchew Creek benthic invertebrates, fishes, and amphibians is based on baseline studies conducted by Thut et al. (1978), Fresh et al. (1979), and Melchiors and Motobu (1978), respectively.

Benthic invertebrate populations at four stations in Sequalitchew Creek (Figure 21) were sampled in June and September 1977, and January 1978 (Thut et al., 1978). The results of these studies may not be representative of an average year because flows in the creek during August and September, 1977, fell to near zero, and according to Weyerhaeuser has occurred several times since then. In June, about the same number of organisms were found at each of the stations, ranging from approximately 14,000 to 21,000 organisms per square meter; however, the species present and their relative abundances varied considerably. In September, during the period of very low flow, populati[illegible] levels w[illegible]e about an order of magnitude lower, and species composition [illegible]ed [illegible]stantially from the earlier sampling. By January, some

recovery in number of invertebrates had occurred, due principally to increases in midges and oligochaete worms. The June samples are probably most representative of typical benthic invertebrate abundance in Sequalitchew Creek; however, no biological certainty can be attached to this because of the limited one-year sampling. In June, populations at all stations were dominated by chironomids. Other dominant groups depended on the substrate and other habitat conditions at the stations and included ostracods, copepods, mayfly and stonefly nymphs (Ephemeroptera and Plecoptera), amphipods, gastropods, and pelecypods.

Sequalitchew Creek is an important downstream transportation corridor for salmonids. Fish species found in the creek during field studies include chum salmon (Oncorhyncus keta), coho salmon (Oncorhyncua kisutch) and cutthroat trout (Salmo clarki) (Fresh et al., 1978). Adult chum are reported to spawn in the lower 650 feet of the creek (Williams et al., 1975). None, however, were observed in field studies in 1978, although chum fry were observed in 1977 (Fresh et al., 1978). In a two-month period in 1978, 417 adult coho were observed in the creek. The presence of juveniles in the creek indicates that cutthroat trout also spawn there. Resident cottids (Cottus asper, Cottus aleuticus) and stickleback (Gasterosteus sp.) were also found in the creek.

The Washington State Department of Fisheries (WDF) uses Sequalitchew Lake as a rearing area for coho salmon prior to their out-migration into Puget Sound. Sequalitchew Creek is the primary pathway for this outmigration. In 1977, 1.2 million coho smolts were released into the lake and outmigrated in May of that year. Due to low creek flows in 1977, some smolts were released into the Fort Lewis drainage canal (Figure 19). A similar release in 1978 was not complicated by low flow, and WDF plans to continue using the creek as a transportation corridor for smolt released into Sequalitchew Lake. Estuarine rearing habitat for salmon smolts from this system is provided at the Nisqually Flats, south of the mouth of Sequalitchew Creek (Williams, 1975). The main purpose of this portion of the WDF enhancement program is to increase the quantity of fish available for sports and commercial fishing, not to establish a coho run in Sequalitchew Creek.

Amphibians captured along Sequalitchew Creek included the Pacific treefrog, Northern red-legged frog, the western red-backed salamander (Plethodon vehiculum), and the Oregon salamander (Ensatina eschscholtzi oregonensis) (Melchiors and Motobu, 1978). Amphibian abundance was highest in summer when approximately 200 amphibians were captured on the site. The red-backed salamander was most frequently observed near Sequalitchew Creek; however, the species was not abundant.

2.7.4 Old Fort Lake

Old Fort Lake is a shallow eutrophic lake whose depth varies with the groundwater level and surface runoff (Melchiors and Motobu, 1978). Both the shallowness of the lake and the substrate's high organic content make possible an abundant and divergent vascular flora.

Six species of aquatic macrophytes were observed in Old Fort Lake by Melchiors and Motobu (1978); all are known to provide food for waterfowl. The species are Canadian waterweed (Elodea canadensis), Indian pond lily (Nuphar polysepalum), water smartweek (Polygonum coccineum), pondweed (Potamogeton spp.), and hardstem bulrush (Scirpus acutus).

Thut et al. (1978) characterized the plankton of Old Fort Lake. Blue-green algae dominated the phytoplankton in June samples (Thut et al., 1978). Cladocerans and copepods were the most common zooplankton groupings. Their numbers were greater in March than during June sampling, indicating seasonal population fluctuations. Relatively low numbers of benthic invertebrates were found; midge larvae were most common.

During the 1977 drought, the lake level dropped and many moist-site terrestrial plants such as everlasting (Anaphalis margaritacea), field pussy-toes (Antennaria neglecta), and American wintercress (Barbarea orthoceras) colonized the edges of the lake. In wetter years these species would not be present.

2.7.5 Nisqually River

The Nisqually River flows into Puget Sound west of the DuPont site (Figure 19). The river is an important habitat for anadromous fish that spend part of their life cycles in Puget Sound.

The Nisqually River supports chinook (Oncorhynchus tshawytscha), coho (Oncorhynchus kisutch), and chum salmon (Oncorhynchus keta), steelhead (Salmo gairdneri), sea-run cutthroat trout (Salmo clarki) and Dolly Varden (Salvelinus malma) (Williams, 1975). The largest yearly spawning run is that of chum salmon, which number 10,000 to 60,000 returning adults per year (USFWS, May, 1977). Upstream migration periods of the various species overlap, and adults of one or more of those species can be found in the river every month of the year.

2.8 MARINE BIOLOGY

Baseline studies conducted on the ecology of the Nisqually Reach dealt with (1) the ecology of intertidal areas (Wisseman et al., 1978), (2) the ecology of subtidal areas (Dames and Moore, 1978), and (3) fish ecology of Nisqually Reach (Fresh et al., 1979). For the purpose of these studies, the intertidal area was defined as the area that extends from the mean lower low water (MLLW) line to +9.0 feet above MLLW. The subtidal area was defined as the area from MLLW to -49 feet below MLLW. In the Wisseman et al. (1978) study, the lower intertidal area was sampled at 0.0 MLLW, the moderate intertidal area at +3.0 MLLW, and the upper intertidal area at +6.0 MLLW. In discussing population density, three categories have been used here - "abundant" (more than 200 individuals/square meter), "common" (2 to 200 individuals/square meter), and "rare" (fewer than 2 organisms/square meter).

The following discussion summarizes results of these baseline studies. For more detailed information the reader is referred to those studies.

2.8.1 Intertidal Habitat

Intertidal life must be adaptable to deal with the stresses of the intertidal zone. Distribution is determined primarily by substrate type, slope and, to a lesser degree, salinity. Because these characteristics change considerably between the wharf area (Transects 1-3, Figure 29) and Nisqually mudflats (Transects 4,5), flora and fauna also differ greatly. The wharf area has a cobble substrate, rather than a silt/sand substrate as found in the mudflats. It also has a steeper slope and water with higher salinity than that of the mudflats as measured by Thut et al. (1978).

2.8.2 Intertidal Flora

Seventy-five species of benthic macroalgae species in each group were observed during baseline sampling (Wisseman et al., 1978). Of these, more than half were red algae, with brown and green algae constituting the remaining species. Dominant species included: Costaria costata, Laminaria saccharina, and Desmarestia viridis (brown algae); Ulva lactuca and Monostroma gigartina stellata (green algae); Porphyra miniata and Iridaea cordata (red algae). Green algae was a dominant fraction of the biomass at some sampled locations. The largest number of species was found north of the DuPont wharf; however, the greatest algal coverage at moderate intertidal levels (+3.0 feet above MLLW) occurred south of the wharf near the mouth of Sequalitchew Creek.

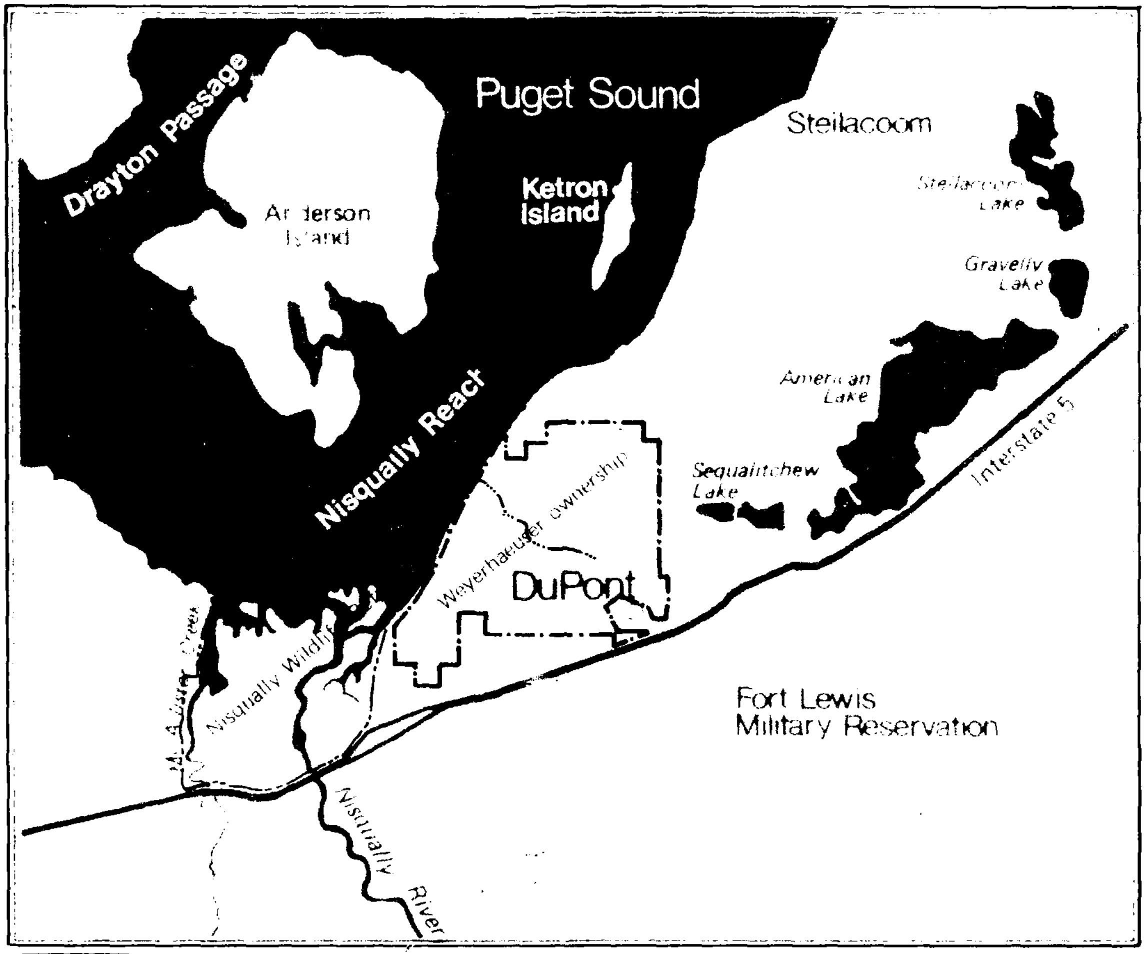
Algal biomass (total wet weight of algae present) at the lowest point on each transect (0.0 feet MLLW) represented 70 percent to 99 percent of the biomass of the transect, indicating that the lower intertidal areas support a far greater algal population than the more exposed areas.

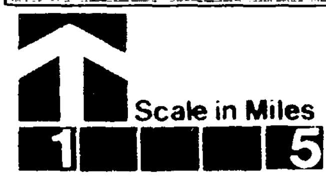
Only ephemeral species of algae that are capable of rapid growth on an unstable substrate were found in the intertidal regions of the Nisqually mudflats. A summer bloom of such algae was eliminated by increased sedimentation during higher river discharge in the fall of 1977.

Eelgrass (Zostera marina) was found only rarely during routine sampling. Because of the importance of eelgrass habitat as a food base for fish and waterfowl, a representative bed was sampled. Characteristics of eelgrass habitat near the proposed site are discussed later in this section.

2.8.3 Intertidal Fauna

During baseline studies conducted by Wisseman et al. (1978), 270 species of intertidal invertebrates were identified. Like the algal communities, the number of species and population density in the lower intertidal zone (0.0 MLLW) was greater than in moderate and upper intertidal areas (above +3 feet MLLW). The dominant epifaunal species, limpets (Collisella sp.), barnacles (Balanus sp., Chthamalus sp.), mussels (Mytilus sp.), and periwinkles (Littorina sp.), were most abundant in the middle intertidal zone. Marine annelid worms (polychaete and oligochaete worms) were abundant infauna in the middle and upper tidal zones. Mollusks were rare except in the lower zone where macoma clams (Macoma sp.) were common.





Legend

1. Habitat Northeast of DuPont Wharf
2. Habitat Adjacent to DuPont Wharf
3. Habitat at Mouth of Sequalitchew Creek
4. Habitat Immediately North of Nisqually River Mouth
5. Habitat Between McAllister Creek and Nisqually River Mouths

Geoduck Tracts

Private Oyster Tidelands

FIGURE 29
INTERTIDAL AND SUBTIDAL TRANSECTS

The most productive area sampled was the lower intertidal area near the mouth of Sequalitchew Creek. This area had the largest populations of infauna (burrowing animals), the greatest number of species, and the highest species diversity. Dominant infauna included polychaetes such as Nereis sp., and oligochaetes, and Macoma sp. Transects near the mud/sand delta yielded many varieties of worms (polychaetes) and clams (Macoma sp.), but fewer gastropods such as limpets, which prefer coarser substrate.

Wisseman et al. (1978) described the shellfish resources of the Nisqually Reach area in their baseline report. Although densities of clam species are not high enough in the Nisqually Delta area intertidally to support a commercial clam harvest, recreational clamming potential is high and has a long history in the area. Noncommercial shellfish harvested recreationally in the Nisqually Reach area include heart cockles (Clinocardium nuttallii), bent nose clams (Macoma nasuta), mussels (Mytilus edulis), moon snail (Polinices lewisii), and sea cucumbers (Parastichopus californicus). Ghost shrimp (Callianassa sp.) are obtained by fishermen for bait from the Luhr Beach area. A commercial oyster farming operation occurs at Hogum Bay. The potential for further development of this oyster fishery is high. Recreational clamming also occurs in intertidal areas along the DuPont shoreline. The Sequalitchew Creek delta area supports populations of butter clams (Saxidomus giganteus) and littleneck clams (Protothaca staminea). Geoducks (Panopea generosa) were occasionally found by Wisseman et al. (1978) near MLLW in the delta area of Sequalitchew Creek. Cancer productus, a smaller relative of the Dungeness crab, is found around the existing DuPont dock. Subtidal shellfish resources are described below.

Thirteen specimens of a rare clam, Rhamphidonta retifera, were found near the 0.0 MLLW level in the Sequalitchew Creek delta. Dr. F. R. Bernard, who discovered and named the species in Canada, has stated that it has been found from California to northern Vancouver Island, and could possibly be found throughout Puget Sound. Since no living specimens have been found along the California, Oregon, or Washington coasts, its range is probably limited to Puget Sound, the San Juan Islands, and Vancouver Island. Its center of abundance is probably in the Vancouver Island region according to Bernard (cited in Wisseman et al., 1978). It is not listed by the U.S. Fish and Wildlife Service (FWS) as endangered, threatened, or protected.

2.8.4 Subtidal Habitat

Subtidal studies were conducted by Dames & Moore (1978) on the Nisqually Reach. The transect lines used in the intertidal study (Wisseman et al., 1977) were extended to include the subtidal area. The study site encompassed the area from +6.0 feet to -49.0 (MLLW). Observations were made in April, August, and November, 1977.

The Dames and Moore study indicated that the most influential factors that determine the nature of the biological communities in the sampled areas were substrate type and depth. Transects 1, 2, and 3 were characterized by a substrate consisting of cobble and gravel sediments. Transects 4 and 5 were characterized largely by a sandy substrate. Another area was identified, occurring beyond 32 feet below MLLW, in which communities were predominately influenced by depth.

2.8.5 Subtidal Flora

Near the wharf (transects 1, 2 and 3), the flora was extensive in spring and summer at shallow depths (to 16 feet below MLLW). Several species of large red (Rhodymenia pertusae and Iridaea sp.) and brown algae (Laminaria saccharina, Nerocystis luetkeana) were present. Sea lettuce (Ulva lactuca), a green alga, was abundant in August. The percent of the bottom covered by macroalgae (percent cover) ranged from 32 to 100 percent (at the -16 foot level, MLLW) and from 0.2 to 34 percent (at the -32 foot depth, MLLW). A thick diatom algal film was present throughout this area except in high-current areas.

In contrast, floral coverage was sparser near the Nisqually Delta, except in summer. During spring and fall, substrate instability and seasonal storms severely limited algal growth. In August, sea lettuce was the dominant green alga covering up to 20 percent of the substrate. The dominant red alga, Neoagardhiella baileyi, was prominent (up to 20 percent of the sample area). A diatom film also developed in the summer.

2.8.6 Subtidal Fauna

Epifauna near the DuPont wharf was rich and varied. Several species of scavenging or predaceous gastropods and crustaceans were abundant. Many small crustaceans were present; these constitute an important food resource for bottom feeding fish. Several sea stars, known to be active predators of the epifaunal community, were observed. The infaunal community in the vicinity of the dock was dominated by polychaetes and, to a lesser degree, amphipods. These groups include deposit feeders and filter feeders, both of which consume organic debris and microalgae.

In general, benthic life (epifaunal and infaunal) was sparser and less diverse in the Nisqually Delta transects. In April, the most abundant epifaunal species was a small cumacean (Lamprops sp.). In summmer and fall, scavenging-predatory gastropods assumed dominance. The sea pen (Ptilosareus guerneyi), a sandy bottom suspension feeder was the most obvious epifaunal organism.

The large sea stars and anemones observed in the wharf area were absent, possibly because of the lack of prey species. Amphipods (Photis brevipes) dominated the infauna; polychaetes were also present. The overall paucity of species was probably due to the dynamic sediments off the face of the Nisqually Delta.

The only subtidal benthic shellfish present in commercially exploitable numbers in the study areas sampled by Dames and Moore (1978) were geoducks. They were present in all transect locations, except Transect 2, located just north of the existing DuPont dock (Figure 29). Densities of 1.7 clams/m2 and 2.0 clams/m2 in Transects 3 and 4, respectively, probably are sufficient to support a commercial geoduck fishery. Goodwin (1973) described densities of geoducks of about 2.5/m2 as abundant, and about 1.0/m2 as above average density. Goodwin's 1973 survey covered a portion of the Transect 5 sampled

by Dames and Moore (1973). He found geoducks to be common at -8 ft (MLLW) in April, but observed none in August and November. Although the full extent of geoduck beds in Nisqually Reach have not been assessed, it is likely that they are common at least between -0.8 feet and -24 feet (MLLW) from the DuPont dock in an arc to the southwest across the front of the Nisqually Delta (Dames and Moore, 1978). Juvenile butter clams were found at low densities (less than $0.5/m^2$) only near the DuPont wharf between -8 feet and -16 feet (MLLW) (Dames and Moore, 1978).

Commercially important crabs were found in low densities by Dames and Moore (1978). Dungeness crabs (Cancer magister) were counted in November only along Transect 1, south of Tatsolo Point. Although this species was seen in the Nisqually Delta area, it was not counted along the transects. The smaller, related species, Cancer productus, was found at relatively higher densities (up to 13.4 crabs/m^2 in April along Transect 1) throughout the study area in the baseline study. Juveniles were more widespread in distribution and occurred in greater numbers than adults (Dames and Moore, 1978). Shrimp (Pandalus jordani) were observed in densities of 10-20/m^2 on cobble substrates along Transects 1 and 2 in November.

Epibenthic fauna, such as harpacticoid copepods and other crustaceans, are major food items for outmigrating juvenile salmonids, as well as resident fish, harvested both commercially and recreationally. These food items are found subtidally, as well as intertidally.

At depths greater than -32 feet MLLW, a distinct complex of four tubicolous polychaetes is found. The complex of tubes formed by these worms provides substrate for many other benthic species, including tunicates, sponges, hydroids, ostracods and hippolytid shrimp.

2.8.7 Special Habitats

The discussion of marine habitats presented above has been divided into two areas--intertidal and subtidal. Some habitats, however, do not readily fit these categories. Three areas will be discussed separately because of their importance to the environment and because of their susceptibility to impacts from the proposed project. These habitats are wharf pilings, saltmarsh, and eelgrass beds. Saltmarsh habitat is discussed in Section 2.8.10. Wharf pilings and eelgrass communities are discussed below.

2.8.7.1 Wharf Piling. The DuPont wharf has been colonized by a wide variety of encrusting and epibenthic organisms (Fresh et al., 1978). The habitat on the DuPont wharf pilings is probably similar to the protected pile habitats described by Ricketts and Calvin (1967) and Kozloff (1973).

Barnacles, mussels, and hydroids are commonly found on such pilings. Rocky-shore crab species have been reported inhabiting pilings throughout the intertidal zone, staying submerged, regardless of tide height (Ricketts and Calvin, 1967). Sea cucumbers and sponges, common in Puget Sound, frequently colonize pilings as well. Other organisms that may be present on the DuPont wharf pilings are seastars, anemones, and tunicates. Fresh et al. (1978)

reported that shrimp, caprellid and gammarid amphipod, isopod, several crab, gastropod, and polychaete populations in the vicinity of the dock are probably enhanced by the piling community.

2.8.7.2 Eelgrass Beds. Eelgrass beds are among the most productive areas in the marine environment (Milne and Milne, 1951; Thayer et al., 1975; FWS, 1980). A variety of functions of eelgrass beds in Puget Sound have been summarized by Thayer and Phillips (1977). These functions include:

1. provision of habitat for commercially and ecologically important fish and invertebrates;

2. provision of protection for small organisms from predators;

3. food source for black brant, coots, Canada goose;

4. large contribution to the detritus-based food web important for many species in Puget Sound, including juvenile salmonids;

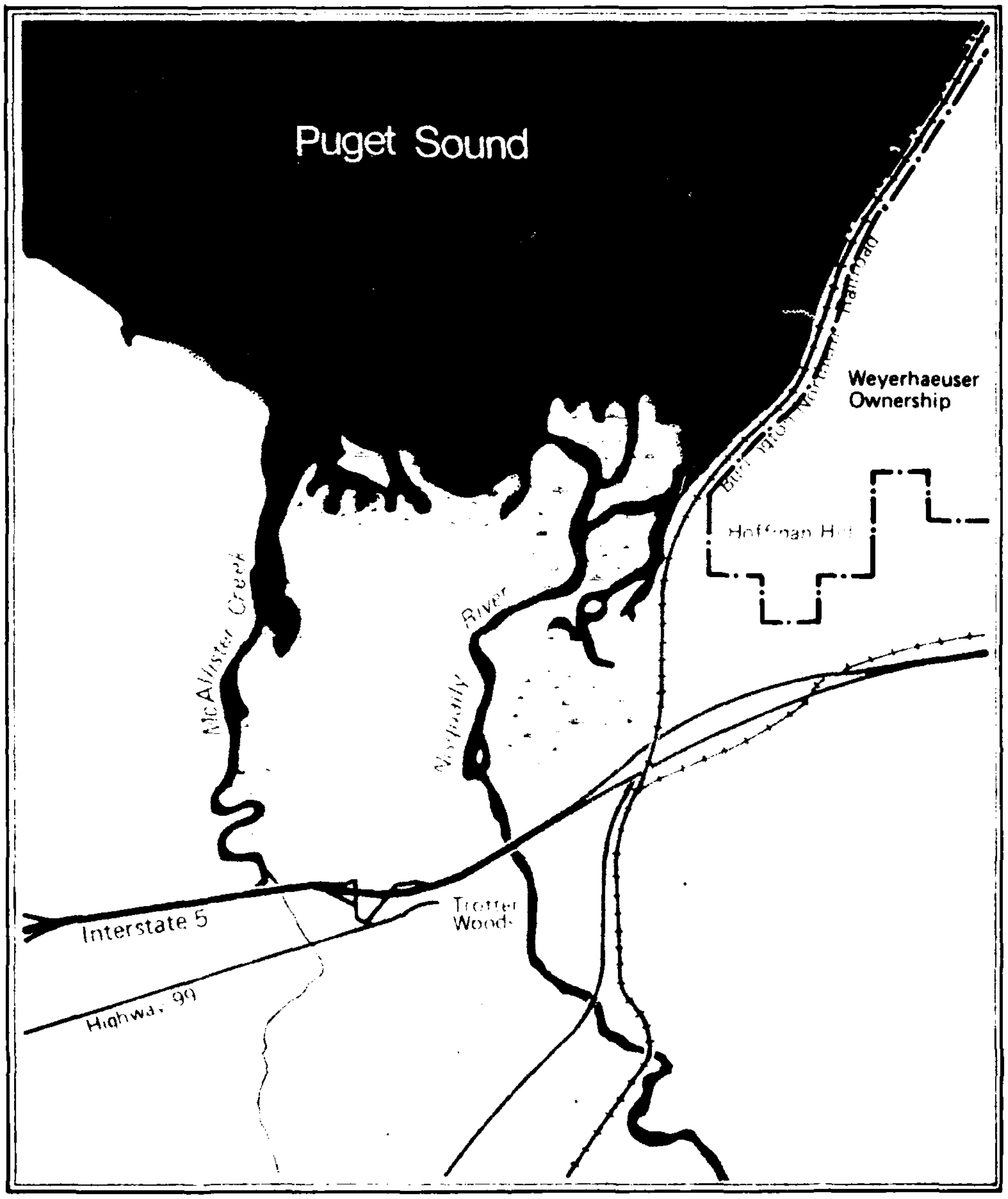
5. blade support of many small epiphytic organisms (organisms that live on plants) important as food for many invertebrates and fish;

6. roots and rhizomes bind the substrate protecting the bottom from erosion, and leaves slow currents and increase deposition of fine sediments and organic matter; and,

7. an important role in nutrient cycling (for example, nitrogen and phosphorus) between sediments and water.

Figure 30 shows the distribution of eelgrass beds in the Nisqually Delta region. An estimated 50 acres of beds lie between McAllister Creek and the DuPont dock (Wisseman et al., 1978). Beds occur in the vicinity of the DuPont dock from the -1.0 (MLLW) level into the subtidal region.

In an eelgrass bed located along an extension of Transect 4 in the northeastern part of the Nisqually Delta and sampled by Wisseman et al. (1978), coverage was variable, ranging from 0-95 percent coverage in the area sampled, with a mean coverage of 25 percent. Standing stock of aerial parts averaged 24 g dry weight/m2 with a range of 0-51 g dry weight/m2 for all samples taken. In eelgrass, annual productivity is about twice the maximum standing crop (McRoy, 1970; Phillips, 1979). Using this relationship, annual productivity in the eelgrass bed sampled by Wisseman et al. (1978) would be about 100 g dry weight/m2. This productivity is less than 20 percent of that reported by Phillips (1974, 1977) as a representative level of annual productivity for eelgrass in Puget Sound. Thayer et al. (1975) give the general range of productivity for Zostera marina as 300 to 600 g dry weight/m2/year. The standing stock measured by Wisseman et al. (1978) also is considerably below estimates reported by McRoy (1970) for 10 locations in Alaska and Keller and Harris (1966) for California populations.



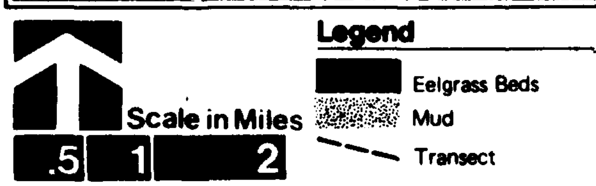


FIGURE 30
LOCATION OF EELGRASS BEDS/NISQUALLY DELTA REGION

In the same area, algal coverage averaged 13 percent with a range of 0-38 percent. Green and red algae were dominant. Common and abundant epifauna observed by Wisseman et al. (1978), included polychaetes (Platynereis bicanaliculata and Harmothoe imbricata) and amphipods (Anisogammarus conferyicolus), especially where the algal coverage was high. Skeleton shrimp (Caprella laeviuscula) was abundant on eelgrass blades.

Infaunal species in the eelgrass beds with the greatest population densities included amphipods, bivalves, polychaetes, and various crustaceans. Refer to Wisseman et al. (1978) for detailed lists of species found in this habitat.

2.8.8 Nisqually Reach

The Nisqually Reach provides both marine and estuarine environments for a variety of organisms. The Nisqually estuary is an area of relatively high fisheries productivity. Baseline studies of the biota in this area have concentrated on fish because of their economic importance (Fresh et al., 1979). Unless otherwise indicated, the following discussion pertains to data collected in the fish ecology baseline study during 1977 and 1978. The fisheries sampling effort was directed toward two groups: salmonids and non-salmonids. The economic importance of the salmonid species merits emphasis.

2.8.8.1 Salmonids. Salmonid species of Nisqually Reach include chum (Oncorhynchus keta), coho (Oncorhynchus kisutch), pink (Oncorhynchus gorbuscha), chinook (Oncorhynchus tshawytscha), and, rarely, sockeye (Oncorhynchus nerka), sea run cutthroat trout (Salmo clarki), steelhead trout (Salmo gairdneri), and Dolly Varden trout (Salvelinus malma). All species spend most of their adult life in marine waters and return to freshwater streams and rivers to spawn. Each salmonid species in the Reach has a characteristic life cycle, although exceptions are common (Figure 31). Adult salmon spawn sometime between late fall and early spring, and die soon after spawning. Various species of adult salmonids may be found migrating through Nisqually Reach throughout most of the year. Once eggs hatch, juvenile salmon migrate downstream--some immediately, some after several months, and some the following spring or summer as yearlings. Steelhead trout remain in freshwater for up to two years prior to downstream migration. The most sensitive time in the Reach for most salmonid species is the juvenile out-migration from March to July. Steelhead juveniles may enter marine and estuarine waters of Washington at all times of the year (WDE, 1977). Significant mortality occurs during the first 60 to 80 days of marine life, probably due largely to predation (Salo, 1979). Mortality rate decreases as the fish increase in size. Data accurately defining the causes and factors for this mortality are unavailable.

The migration routes of juvenile salmon in Nisqually Reach, originating from the Nisqually River and other streams in southern Puget Sound, appear to vary seasonally and annually. In general, salmon and trout tend to follow shorelines, remaining in shallow water during their early estuarine/marine

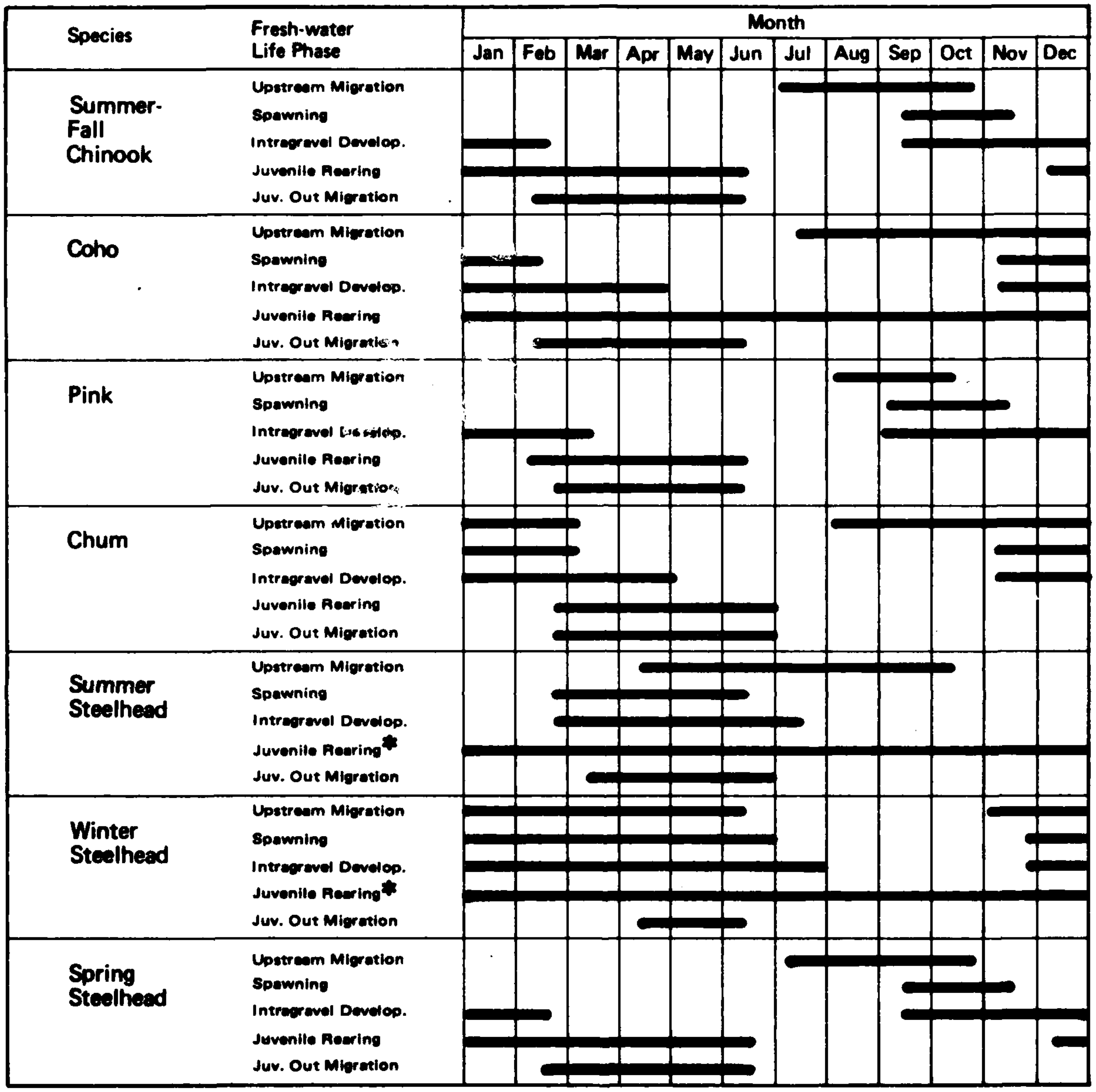


FIGURE 31
TIMING OF SALMON AND STEELHEAD FRESHWATER LIFE PHASES IN NISQUALLY BASIN

✱ Normally extends over a two-year period.

Source: Pacific Northwest River Basins Commission. Comprehensive Study of Water and Related Land Resources. Puget Sound and Adjacent Waters. Appendix XI, Fish and Wildlife March 1970

residence. The Washington Department of Fisheries has conducted visual surveys since 1964 indicating that juvenile salmon are abundant to the west and north of the Nisqually Delta (Morrill, 1974).

The fish ecology baseline studies provided salmonid migration data during 1977 and 1978 (Fresh et al., 1979). Results for the two years are not strictly comparable, however, since sampling frequency and gear differed in the two years, and 1977 was unusually dry.

Peak outmigration of juvenile chum salmon occurred from mid-March through late June in 1978. More chum outmigrated along the Anderson Island and west Nisqually Reach shorelines than along the DuPont shoreline, especially through late May; however, numbers of juvenile chum salmon caught along the DuPont shoreline increased during May and June, compared to March and April samples, especially in townet samples of deeper nearshore waters. Based on these results, it appears that most juvenile chum move along the DuPont shoreline later in the season and in more offshore waters, than along other shorelines sampled. Because of the low frequency of townet collections, however, the relative abundances of chum moving in more offshore waters sampled by the townet may have been underestimated (Fresh et al., 1979).

It should be noted that the conclusion that chum use of the DuPont shoreline is relatively lower than use of other Nisqually Reach shorelines is based on limited sampling in the baseline study. It is possible that spatial distribution of chum salmon in Nisqually Reach characteristically varies annually, according to Fresh et al. (1979). They also suggest, however, that low abundances of harpacticoid copepods and relatively stronger currents may make the DuPont shoreline less suitable habitat, at least in April and May, when harpacticoid copepods, which are found in shallow areas, are the principal food for juvenile chum, and when juvenile chum are small and more subject to relatively strong currents characteristic of the DuPont shoreline. Later, in May and June, juvenile chum catches in more offshore waters were greater at DuPont than in earlier samples. This corresponds to an increased chum size and a prey shift to calanoid copepods, which are more abundant in May and June, particularly in more offshore waters.

Coho outmigrated primarily along Anderson Island. Few coho were caught along the DuPont shoreline during baseline studies. This suggests that coho, other than those released in Sequalitchew Lake, may not migrate extensively along the DuPont shoreline. It may, however, also reflect underestimation of the number of coho resulting from avoidance of sampling nets due to the sharp subtidal slope. Although coho salmon were caught between mid-April and mid-July, the major outmigration of coho occurred during May.

Chinook juveniles were found north, east, and west of the mouth of the Nisqually River, including along the DuPont shoreline. Spatial differences in abundance of these juveniles, released in streams tributary to southern Puget Sound, were less pronounced than differences in coho and chum abundance, possibly because fewer chinook were caught. Outmigration of juvenile chinook salmon occurred later than for other salmonid species during the baseline

studies, with peak movements in mid- to late June in 1978. Peak offshore catches at DuPont occurred in late May and mid-June, as with coho and chum salmon.

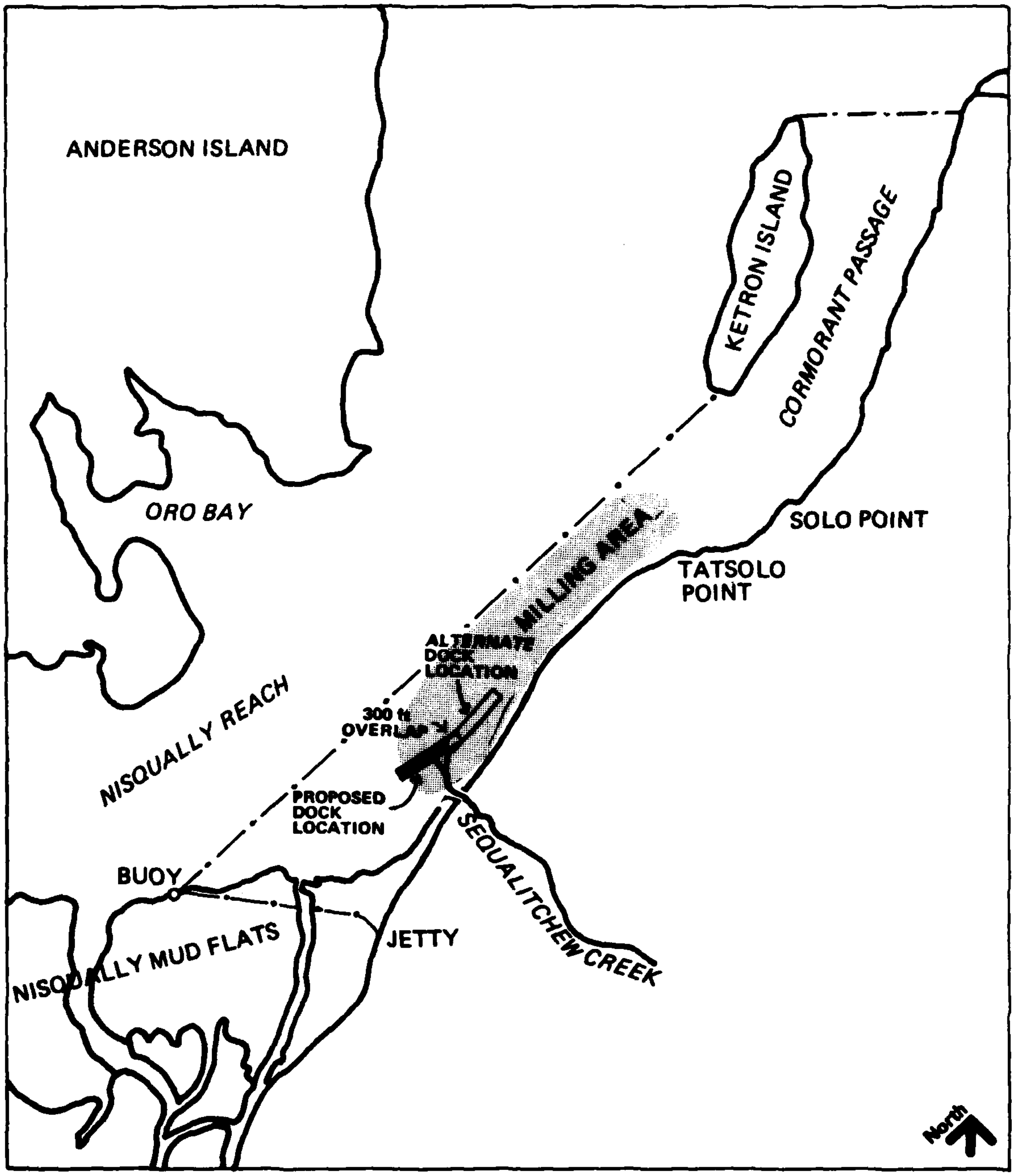
According to the baseline study, in the early part of their residency in Nisqually Reach, juvenile chum, coho, and chinook salmon feed primarily on epibenthic plankton and macroinvertebrates, including harpacticoid copepods, gammarid amphipods, cumacean, isopods, and shrimps. Later in the season, as fish size increases and the abundance of neritic plankton increases, juvenile chum, coho, and chinook feed predominantly on neritic organisms. Juvenile pink salmon typically feed on neritic plankton, especially calanoid copepods. Catches of juvenile pink salmon were low in all 1977 and 1978 samples along the DuPont shoreline. Peak catches occurred in nearshore areas from the end of March through mid-April along non-DuPont shorelines.

These data indicate that although more juvenile salmon moved westward from the Nisqually Delta than eastward, the eastern shore (DuPont wharf to Tatsolo Point) is a commonly used pathway for migrating juvenile salmon. Variations in migration routes and limitations in the sampling of such a large area preclude firm conclusions on salmon migration routes.

Adult salmonids also migrate along the DuPont shoreline. Coho salmon was the predominant species caught with commercial purse seining gear by Fresh et al. (1979) along the DuPont shoreline during October and November, 1977. Relatively small numbers of chinook, chum, and steelhead were caught at that time. According to Fresh et al. (1979), peak migration of adult coho salmon along the DuPont shoreline probably occurs during September and October. Tag returns from adult coho tagged near the DuPont dock indicate that the DuPont shoreline may be used as a milling area by these fish. Most tags were recovered from southern Puget Sound, the Nisqually River, and Chambers Creek. According to Fresh et al. (1979), sampling conducted by the U.S. Fish Wildlife Service (FWS) in 1974-1978 indicated large catches of chum salmon along the DuPont shoreline in December and January. Peak migration of adult chum salmon along the DuPont shoreline is likely during December and January. Adult chum tagged in this area during December and January were caught mainly in the Nisqually River. The milling area for coho and chum between Ketron Island and the DuPont dock is shown in Figure 32.

Washington Department of Fisheries (WDF) management periods for streamward migrations of chinook, chum, and steelhead are as follows: chinook - July to mid-September; chum - mid-October to January 31; pink - August to September; steelhead - mid-November to April.

Planned salmon enhancement programs to be carried out by the WDF in cooperation with the the Nisqually Tribe will result in comparable or larger returns of coho and chinook salmon in the future (see 2.8.10 and Appendix F). The Sequalitchew Lake coho program, for instance, involved release of 2.9 million fish in January 1980. Approximately the same number were planted in the lake in January 1981, and released to Sequalitchew Creek and Nisqually Reach in May 1981. Approximately one million coho will be planted in Sequalitchew Lake yearly for the next three to five years. The purpose of this



LEGEND

HARVEST AREA BOUNDARY

MILLING AREA (AS DETERMINED FROM TAGGING STUDIES) (COHO & CHUM SALMON)

0 1000 2000 3000 4000 YARDS

SCALE

FIGURE 32
NISQUALLY TRIBAL HARVEST
AREA (SEQUALITCHEW)

Source: Nisqually Indian Tribe 1977

enhancement program, according to Darryl Mills of the WDF, is not to establish a run in Sequalitchew Creek, but rather to increase the number of harvestable salmon for sports and commercial fishing in Puget Sound. Planting these fish in sourthern Puget Sound increases the exposure time of fish returning after three years to commercial and sports fishing.

2.8.8.2 Non-salmonids. Beach seining operations conducted by Fresh et al. (1978) yielded a total of 3666 individuals and 43 species. The Nisqually Delta site produced the most fish. The most common non-salmonids were Pacific staghorn sculpin (*Leptocottus armatus*) and starry flounder (*Platichthys stellatus*). Common commercially and recreationally important species occurring in the area include Pacific herring (*Clupea harengus pallasi*), surf smelt (*Hypomesus pretiosus*), striped seaperch (*Embiotoca lateralis*), pile perch (*Rhacochilus vacca*), rock sole (*Lepidopsetta bilineata*), and English sole (*Parophrys vetulus*) (DNR, 1972). Herring have been occasionally observed along the DuPont shoreline in large concentrations throughout the year (Svoboda, personal communication, 1980).

Demersal fish occurrence at Tatsolo Point, DuPont wharf, and Outer Nisqually Delta was studied between March 1977 and March 1978 using a trynet: 4,277 fish representing 41 species were caught. The most numerous were English sole and rock sole. Slightly more species (31) and considerably more fish (1,809 or 42 percent) were caught at the DuPont dock than at the other two stations.

The piling habitat under the DuPont wharf was characterized by SCUBA diver observations because of severe restrictions on various types of sampling gear. The most abundant demersal and non-demersal species were buffalo sculpin (*Enophcys bison*) and shiner perch (*Cymatogaster aggregata*), respectively. Potential predators to small fish, such as juvenile salmon, included Pacific tomcod (*Microgadus proximus*), buffalo and staghorn sculpin (*Enophrys bison* and *heptocottus armatus*), rockfish (*Sebastes* spp.), cabezon (*Scorpaenichthys marmoratus*), rock sole, starry flounder (*Platichthys stellatus*), and adult salmon.

English sole and rock sole were checked for nematodes (parasitic worms) at each station. The overall infection rate was 41 percent. The data was quite variable, however, from month to month, and no single station showed a constantly high rate of infection. Comparable infection rates of nematodes at Stadium in Case Inlet were found, but lower rates were found at Union in Hood Canal (Miller et al., 1974; cited in Fresh et al., 1979). No tumors (epidermal papillomas) were found in any rock sole specimens. Tumors (epidermal papillomas) were observed occasionally at all stations for English sole, but the rate of occurrence was only 5 percent (Fresh et al., 1979). This rate of occurrence is similar to what has been observed in other areas of Puget Sound (Fresh, 1981).

A study of trophic relationships conducted by Fresh et al. (1979) was based upon examination of fish stomach contents. One objective was to determine the extent of predation upon salmon fry occurring within the Nisqually Reach. None of the species examined contained salmon fry to any significant extent [i.e. contributing more than two percent to the total index of relative importance (IRI)]. Fry remains were found in coho and chinook salmon,

buffalo and Pacific staghorn sculpin, searun cutthroat, and steelhead. Too few of the latter two species were collected to allow a statistical evaluation of stomach counts. The most likely predators of salmon fry were older juvenile salmon and Pacific staghorn sculpin.

2.8.8.3 Zooplankton and Ichthyoplankton. Plankton were sampled by Fresh et al. (1979) using net hauls at three nearshore locations: Tatsolo Point, the DuPont Dock, and the middle section of the Nisqually Flats during March-July, 1977. The three sites were found to have similar populations. Calanoid copepods were the most numerous zooplankton, but other forms were abundant including crab zoea, cnidaria, and caridean zoea. Fish eggs and larvae were dominated by gadoids (soft-finned fishes) and plaeronectids (flatfish). English sole larvae were the most abundant flatfish larvae. Mean numbers of the various components of the plankton are reported in Fresh et al. (1979).

Relative abundances of calanoid copepods decreased from March to April before increasing in May and remaining at high densities through July. Peak catches of crab zoea occurred during April. Cnidaria abundance was relatively low during March and April, but increased steadily through July. Both fish eggs and fish larvae were collected in greatest abundances in April and then decreased steadily through July.

Thut et al. (1978) used the chlorophyll content of surface and deeper waters (Section 2.5.4) at sampling stations in Nisqually Reach (Figure 24) as a measure of phytoplankton standing crop. According to these measurements: (1) highest phytoplankton concentrations would be expected in surface waters (only samples from surface waters were in the euphotic zone), and (2) large spring blooms of phytoplankton followed by smaller blooms in the fall may be typical. Chlorophyll values were generally higher at Station 2 than at other Nisqually Reach locations. The significance of this is unknown.

2.8.9 Fisheries in Southern Puget Sound

2.8.9.1 General. Commercial and sport fishing areas occur throughout Nisqually Reach. Commercial fishing is regulated by the Washington State Department of Fisheries (WDF) and by the signatory tribes to the Treaty of Medicine Creek (Nisqually, Puyallup, and Squaxin Island). The state licenses non-treaty commercial boats and the tribes license treaty Indian fishermen.

2.8.9.2 WDF/WDG Fisheries Enhancement. The Nisqually Valley and adjacent areas have some of the best potential for future salmon enhancement in the state (Thurow, 1977). WDF has initiated a substantial salmon enhancement program in the Nisqually Reach area. Current WDF plans for southern Puget Sound are shown in Table F-4, Appendix F. Sequalitchew Lake has been used for rearing and release of coho since 1977. WDF considers the Sequalitchew Lake program a successful low cost program and plans to continue it. In January 1980, 2.9 million coho fry were planted in the lake. A similar release occurred in 1981 (Darrell Mills, personal communication, 1981).

Releases of approximately one million coho per year from Sequalitchew Lake are planned during the next three to five years. Two releases of fall chinook were made from the Schorno Springs facility in spring 1980 (Antipa, 1980).

The WDG plants winter and summer steelhead in the Nisqually River on a regular basis. Plants of up to 175,000 steelhead were made during the 1970's (although most plantings were on the order of 10,000 - 30,000).

2.8.9.3 Treaty Fishing Rights. Usual and accustomed fishing areas are judicially determined fishing areas where members of a tribe customarily fished from time to time at, and before, treaty times, and where tribal fishing rights are presently held. These areas were defined in Federal District Court's specific findings in United States v. Washington (384 F. Supp. 312), known as the Phase I Boldt decision. This decision confirmed the Indian treaty right to continued fishing in the case area, guaranteed physical access to their usual and accustomed fishing areas, and established the allocation scheme allowing the Indians one-half of the harvestable case area fish. In 1979, the U.S. Supreme Court reviewed the Boldt decision and reaffirmed its findings, adding the concept of an allocation scheme allowing a sufficient quantity of fish to provide a moderate living standard.

A later case (Phase II) heard in U.S. District Court, Western District of Washington, by Judge Orrick, determined that harvestable fish include hatchery-bred fish in addition to those derived from natural runs (United States of America et al. v. State of Washington et al., Civil No. 9213 - Phase II). Phase II also determined that it was the state government's responsibility to refrain from actions that would degrade fish habitat to an extent that would deprive the tribes of their moderate living needs. The degree of allowable deterioration suggested by this determination has not yet been determined.

According to Judge Orrick's decision, certain burden of proof rules apply to help orderly adjudication of a tribe's contention that a certain governmental action will result in significant fish habitat degradation. The initial burden of proof falls on the plaintiff to show that the challenged action will proximately cause the fish habitat to be degraded "...such that the rearing or production potential of the fish will be impaired or the size or quality of the run will be diminished" (U.S. et al. v. Washington et al., September 26, 1980). Once the initial burden of proof is satisfied, then the burden switches to the government to show that the State's actions (including the authorization of third party activities) will not impair the tribe's ability to satisfy their moderate living needs. If an issue of facts exists, then an evidentiary hearing must be held at which the plaintiff is permitted to meet their burden as discussed above (Judge Belloni, in opinion No Oilport! v. James Earl Carter, Civil Action No. C80-360 M).

2.8.9.4 Tribal Fisheries in Nisqually Reach. The Squaxin Island Tribe has released juvenile salmon into Nisqually Reach raised at the Squaxin Island Sea Hatchery and the Elson Creek Hatchery for approximately the past 10 years (Rentzel, personal communication, 1981). Approximately 3 million chum and 225,000 chinook salmon were released from the Elson Creek Hatchery in May, 1981. About 900,000 coho smolts were released from the Squaxin Island Sea Hatchery in June, 1981. Many of these fish were expected to migrate through the Nisqually Reach area.

The Nisqually Tribe has also established an enhancement program in the Nisqually Reach area. This program is a cooperative effort with WDF, and is summarized in Table F-5, Appendix F. Up to 2.2 million chinook and 4.8 million chum are expected to be released annually into the Nisqually system from the tribal hatchery on the Nisqually River for the next several years.

Nisqually Reach is one of the judicially determined usual and accustomed fishing areas of the Nisqually and Squaxin Island tribes, as recognized and affirmed by recent federal court interpretation of treaty Indian fishing rights [99S.Ct. 3055(1979); see also 384 Fed. Sup. 312 (1974)]. The Nisqually River and Sequalitchew Creek are also usual and accustomed fishing areas of the Nisqually tribe, which has an active salmon fishery in the Nisqually River.

The Nisqually Indians continue to fish the DuPont shoreline, as they have done historically. Recent fishery enhancement programs have provided for limited commercial seasons in the area, particularly near the shoreline between Sequalitchew Creek and Tatsolo Point. A coho and chum fishery was opened in the fall of 1977 for non-treaty fishermen and treaty Indians. Since then, the Nisqually Tribe has conducted a fishery along this shoreline. Indian gillnetters operate in the area shown in Figure 32 and consider Nisqually Reach to be a prime fishing area.

Indian fishermen generally use gillnetting equipment rather than purse seining boats because the required capital investment is much lower for gillnetting. Gillnets are also more suitable in the area's swifter currents than the more cumbersome purse seine gear. Gillnets are drifted with the tide and must be lifted a quarter of a mile before any permanent obstruction to avoid entanglement. On an ebb tide, fishermen lay out their nets, which are up to 1,800 feet long, toward the southern end of the area and allow them to drift north until they are full or seem likely to get caught up in an obstruction. On a flood tide, nets are laid out toward the northern end of the area. Nets must be lifted one-fourth mile before any permanent obstruction, for example the DuPont wharf, to avoid entanglement with it.

As they have done in the past, Nisqually tribal fishermen today conduct commercial salmon fishing with beach seines. In this method, one end of the net is stationed on the beach while the opposite end is taken out with a skiff so that the net lies perpendicular to shore. It is then arched back towards shore, encircling a fish school if possible. Beach seining is conducted along the open DuPont shoreline to harvest Sequalitchew coho that mill there in relatively high numbers.

Nisqually Indian treaty fishing rights extend to nonsalmonid species. The tribe does not at present have a commercial fishery for nonsalmonids, but may in the near future. Furthermore, tribal members use the Nisqually Reach and DuPont shoreline for subsistence and recreational harvesting of non-salmonid fish species and shellfish, as they have done traditionally.

2.8.9.5 Sports and Commercial Fishery. An analysis of salmon punch card data for the early 1970's by the Oceanographic Institute of Washington indicates that as many as 3,000 sport anglers might fish in southern Puget Sound each week in June, July, and August, with half that many fishing these waters in the Spring and Fall months. Perhaps as many as 1,000 anglers per week seek bottom fish in mid-Winter. The salmon enhancement program in Sequalitchew Creek has increased sports fishing interest along the shoreline in the vicinity of the creek mouth.

Commercial and sports catches for the years 1977-1979 are shown for the Nisqually Reach and River in Table 9. Coho and chum account for the vast majority of the commercial catch, while chinook and coho account for the bulk of the sports catch. Virtually none of the sports catch is taken from the Nisqually River.

TABLE 9

MEAN SALMON CATCH 1977 - 1979

Commercial

	Nisqually Reach	Nisqually River
Chinook	538	506
Coho	20,256	4,781
Chum	6,170	20,381
Pink	22	180

Sports Catch

	S. Puget Sound, South of Tacoma Narrows	Nisqually River
Chinook	29,017	12
Coho	14,404	18
Chum	152	0
Pink	481	0

Source: Washington Department of Fisheries, 1980.

2.8.10 Wetlands

Corps of Engineers regulations [33 CFR 323.2(C)] define wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs, and similar areas and are important for a variety of reasons. Some important functions are as follows:

1. serve important natural biological functions, including food chain production, general habitat, and nesting, spawning, rearing and resting sites for aquatic or land species;

2. serve as valuable storage areas for storm and flood waters;

3. can be important in shielding other areas from wave action, erosion, or storm damage;

4. serve as prime natural recharge areas (locations where surface and groundwater are directly interconnected); and

5. serve to purify water through natural water filtration processes (Corps of Engineers, 1979).

Both freshwater wetlands and saltwater influenced wetlands occur on the DuPont site and in the neighboring project area. Features of these wetlands are discussed below.

Freshwater marshes with a combined area of 131 acres occur on the DuPont site, according to the baseline study by Melchiors and Motobu (1978). These marshes are of two main types: (1) seasonally ponded wetlands and (2) permanent wetlands fed by surface and groundwaters. The former are generally found in shallow kettles and are dominated by herbaceous growth. A total of 70 species of forbs and grasses were identified from the marsh areas in the 1977 baseline study.

Edmond Marsh, an area of wooded/shrubby swamp, is a permanent freshwater marsh, the largest at the DuPont site (Figure 26). Western crabapple (Pyrus fusca) is the dominant tree in Edmond Marsh. Willows (Salix spp.) and Oregon ash (Fraxinus latifolia) are also common species, especially in wet areas bordering the kettle marshes. The most common shrubs are spiraea (Spiraea douglasii), black hawthorn (Crataegus douglasii) and Nootka rose (Rosa nutkana).

Melchiors and Motobu (1978) noted aquatic herbaceous vegetation growing in Edmond Marsh where slowly flowing or standing water was present. Edmond Marsh is drained by Sequalitchew Creek. Marsh plants include 18 species of trees, 12 shrub species, 55 species of forbs, and 15 species of grasses and grass-like plants. Common herbaceous plants in the marsh include cattails (Typha latifolia), yellow monkey-flower (Mimulus guttatus), spearmint (Mentha spicata), sedge (Carex sp.), and reed canarygrass (Phalaris arundinacea).

A peat bog area also exists on the DuPont site, in which the most common trees are lodgepole pine (Pinus contorta) and western hemlock (Tsuga heterophylla). Bog birch (Betula glandulosa) is the predominant shrub, growing densely in all areas except under trees. Ground cover is almost entirely a thick layer of moss over a moist layer of peat.

A small salt marsh covering approximately 0.5 acres occurs near the mouth of Sequalitchew Creek on the upland side of the Burlington Northern railroad berm and tracks. Influx of water from Nisqually Reach occurs at high tide through the Sequalitchew Creek culvert under the Burlington Northern tracks. Sedge (Carex lyngbyei) occurs in homogeneous stands along drainage channels in this small marsh at the lowest elevations. At slightly higher elevations in the marsh away from the drainage channels, Pacific silverweed (Potentilla pacifica), dock Rumex sp., Atriplex patula, and grasses are common.

The Delta and its associated salt marsh represent a relatively uncommon resource, especially in the Southern Puget Sound area. The rarity of large salt marshes in Puget Sound serves to enhance their educational and aesthetic value to the people of the region. The marsh's value in forms of recreation such as hiking and bird-watching is considerable. The objective of preserving the Delta and marsh has been partially achieved by its inclusion in the system of National Wildlife Refuges.

The Nisqually Delta, the northeastern-most boundary of which is located approximately one-half mile southwest of the proposed dock location, is an actively evolving system. Several distinct habitats exist in the area--ranging from a mature river valley forest to the littoral area offshore in the Nisqually Reach (Figure 27). The gradual succession from littoral area to mudflat, salt marsh, freshwater marsh, meadow, and forest is controlled by silt deposition. River silts deposited near the mouth of the Delta are actively redistributed by the tides.

Plant material produced on the Delta, if not flushed away or decomposed, contributes to gradually increased land elevation through incorporation of organic materials into the soil. Chapman (1976) described examples of succession within temperate region salt marshes. A common pattern, starting from seaward, is the development of beds of eelgrass in the intertidal and subtidal areas. This development of plant life results in a more efficient trapping of sediment, accelerating the rate of deposition. Deposition is greatest on the lowest plant-covered marshes and eelgrass beds as these areas are inundated most frequently. Deposition rates ranging from 0.2 to more than 4 cm/yr have been measured in some salt marshes (Conservation Foundation, 1974). The higher rates are for marshes in close proximity to a river as are the Nisqually wetlands.

The main factors establishing vegetation zones within the Nisqually salt marsh are salinity of the water and elevation-inundation frequency/duration, according to Burg et al. (1975, 1980), who identified 12 distinct vegetation associations in the Nisqually salt marsh. The plant assemblages tend to form a number of zones, each dominated by relatively few species and shows a low level of diversity (Burg et al., 1975). Dominant species include seashore

saltgrass (Distichlis spicatum), pickleweed (Salicornia virginica), saltmarsh sandspurry (Spergularia marina), sedge (Carex lyngbyei), Pacific silverweed Potentilla pacifica, Jaumea (Jaumea sp.), tufted hairgrass (Deschampsia caespitosa), Baltic rush (Juncus sp). and red fescue (Festuca rubra).

Drainage within the Delta/salt marsh system is accomplished by several wide channels each of which is a complex system of winding sloughs. Sloughs represent distinct habitats within the salt marsh (MacDonald, 1969).

Several small areas of freshwater marsh occur in the upper central portion of the Nisqually Delta (Figure 27). Plant species dominating the freshwater marshes in the Delta vary seasonally and from one area to another. Common plants include rushes (Juncus spp), cattails (Typha latifolia), sedges (Carex spp.), and grasses.

The intertidal mudflats of the Nisqually Delta seasonally support vegetation. Significant summer growths of macroalgae, particularly Enteromorpha and Ulva were found on the mud and sand flats during the baseline studies (Wisseman et al., 1977).

Net primary production in the Nisqually Salt Marsh was measured for eight plant associations by Burg et al. (1975, 1980). Net annual productivity ranged from 90 g dry weight/m^2 to 1,390 g dry weight/m^2 depending on the association sampled. Average annual net productivity for these eight associations was 814 g dry weight/m^2. The Festuca rubra - Carex lyngbyei association was the most productive of the associations found at high elevations (1,086 g dry weight/m^2), while the Carex lyngbyei association, found at low elevations, was the most productive of all the associations sampled (1,390 g dry weight/m^2). The total dry weight net production of the eight associations sampled was estimated to be 1,670 metric tons produced over an area of 192.9 hectares.

Eilers (1975) reported annual net productivity levels ranging from 518 to 1,936 g dry weight/m^2 for marsh communities in the West Island Marsh, Nehalem Bay, Oregon. The values reported above for the Nisqually area are generally comparable to those reported by Eilers, although some Nisqually communities are less productive than the least productive communities in the Oregon marsh.

2.8.11 Ecological Relationships

Although macrophytes of nearshore areas (including salt marsh vegetation, algae, and eelgrass) are important primary producers, a relatively small percentage of this biomass enters grazing food chains through direct consumption by herbivores (Milne and Milne, 1951; Phillips, 1979; Simenstad et al., 1979). A greater proportion enters the marine food web as detritus. Eilers (1975) reported that net production does not accumulate year after year on the marsh surface; after a year, nearly three-fourths of the above ground production in the salt marsh on West Island, Nehalem Bay, Oregon, was incorporated into the marsh soil or exported to the larger estuary system. At lower marsh elevations, almost all that was produced above-ground was removed by the tides and entered the detritus pool in the nearshore areas.

Figure 33 illustrates that the majority of the food links to higher trophic levels in both the saltwater marsh and littoral/sublittoral areas are through detrital feeders. Simenstad et al. (1979) found detritus to be the primary food source in 6 of 7 food chains described in studies of Northern Puget Sound and the Strait of Juan de Fuca. They conclude that "...while some autotrophically produced biomass is directly transferred to higher trophic levels, the majority appears to reach maturity and detach and decompose in the nearshore region, eventually providing a pool of suspended and dissolved organic matter available for heterotrophic conversion to decomposer biomass."

Dames and Moore (1978) concluded that much of the nearshore algae growth in the vicinity of the Nisqually Delta is being transported to deeper waters in the form of detritus, thereby helping to support a richer faunal assemblege than might otherwise exist. Transport of detritus in the Delta food web is illustrated in Figure 33.

The Delta wetlands serve as a vital rearing area for a variety of fish, most notably juvenile salmon. Juveniles may linger in the sloughs and nearshore waters of the Delta for several weeks to several months before continuing their seaward migration. That these waters are an important feeding and acclimation area is supported by work that Congleton and Smith (1976) carried out on stomach analyses of chum and chinook juveniles in another Puget Sound marsh, the Skagit salt marsh (Skagit River, Washington). Their analyses showed that chum salmon were active feeders in tidal streams, feeding primarily upon amphipods, copepods and insects.

As discussed in Section 2.6.4 the Nisqually Delta is an important habitat for both local bird populations and migrating visitors. It is an important resting area on the Pacific flyway, providing a feeding and resting area for many thousands of migrants annually. Figure 33 illustrates the manner in which some bird species enter the Delta food web.

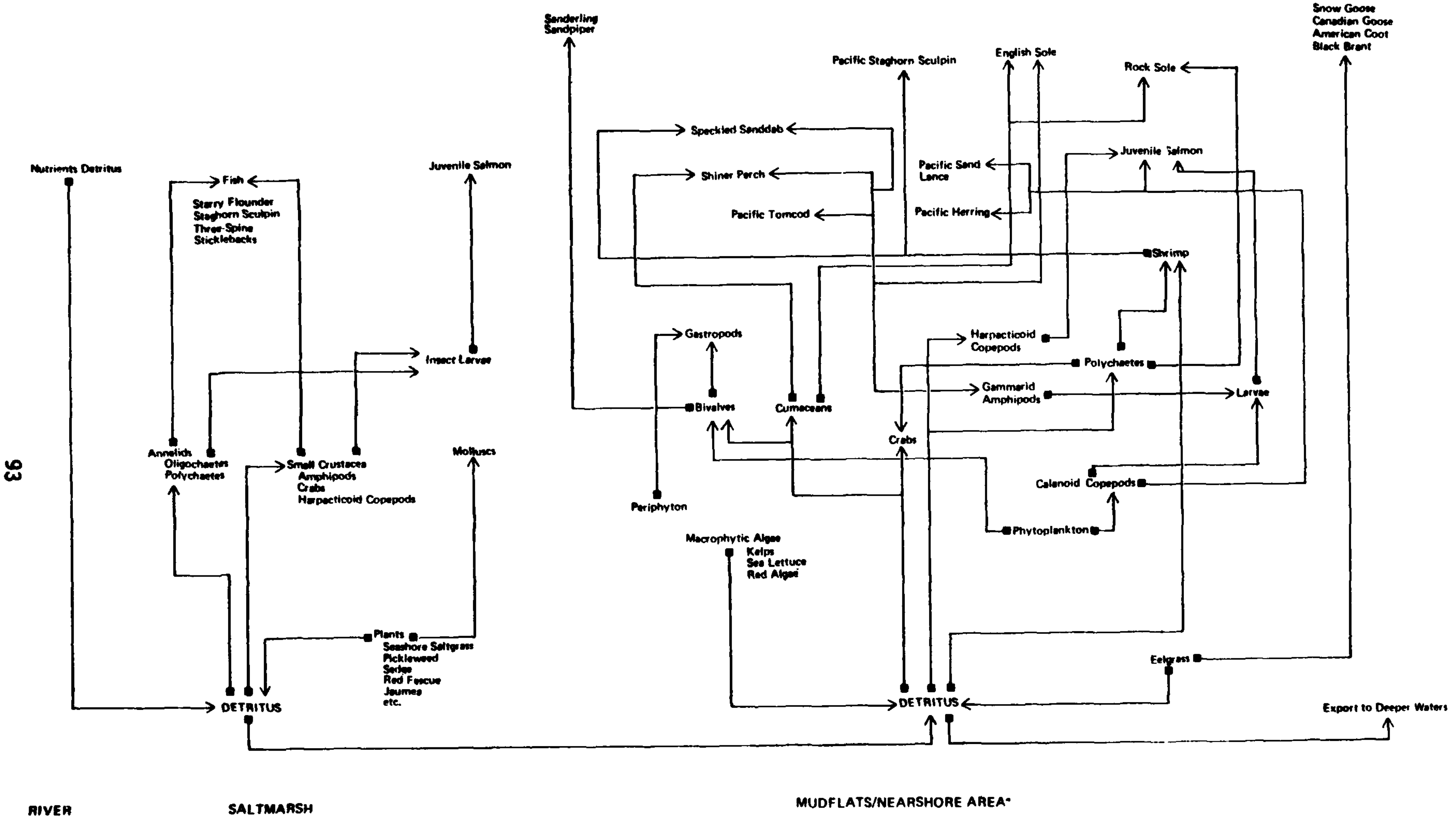
2.9 NOISE

This section discusses existing sources of noise and measured noise levels near the DuPont site. Background noise levels were measured by Crawford (1977). The latter are then compared with noise criteria, which are listed in Appendix G. For more detailed information on noise levels and noise measurement techniques, see Crawford (1977) and Towne, Richards and Chaudiere (TRC, 1980).

The area potentially subject to noise impacts from the proposed export facility presently receives noise generated by numerous sources. Some of these sources can be inferred from examination of Figure 34. The major existing noise sources include the Interstate-5 Corridor and Fort Lewis.

2.9.1 Sources of Noise

The major source of ambient noise in the DuPont vicinity is traffic noise, especially from Interstate 5. On Anderson Island there is no steady source of background noise. Intermittent noise sources include aircraft,



*Source: Simenstad et al (1979)

FIGURE 33
FOOD WEB IN THE
NISQUALLY DELTA AREA

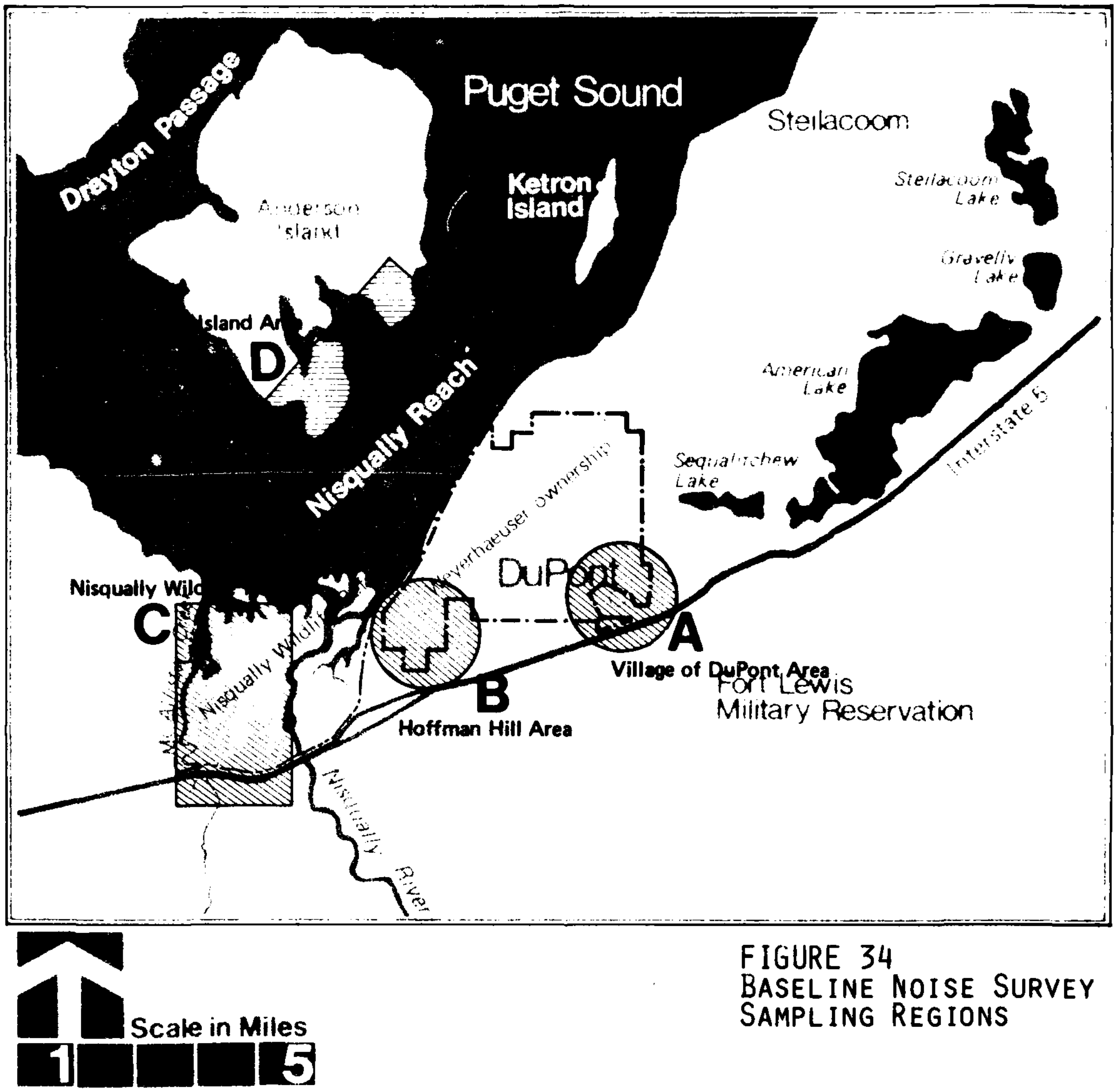


FIGURE 34
BASELINE NOISE SURVEY
SAMPLING REGIONS

military helicopters, trains, and artillery fire and demolitions training at Fort Lewis. Measured noise levels were below EPA and HUD standards. WAC standards were occasionally exceeded.

Traffic on Interstate 5 and other roads is a major source of noise in the region. The railroads are sporadic noise sources. Training activities at Fort Lewis are a significant source of intermittent noise.

Highways near the site with traffic volumes large enough to produce noise levels annoying to local residents include Interstate 5 and SRs 101 and 512. Noise levels generated by these roads can be estimated from peak-hour traffic volumes. Noise levels calculated for these roads are shown in Table G-3, Appendix G. Local access roads near the site include Mounts Road, Barksdale Avenue, and the DuPont-Steilacoom Road. Peak-hour traffic volumes on these roads are not high enough to produce annoying noise levels.

Noise generated by trains is loud but sporadic and varies with factors such as speed, type of locomotive, and type of load. Typical noise levels generated by trains are shown in Figure 35; noise levels 50 feet from the track range up to 98 dBA. Traffic on the line along Puget Sound averages six passenger trains and 24 to 30 freight trains per day. The railroad line adjacent to Interstate 5 is used by several trains per day.

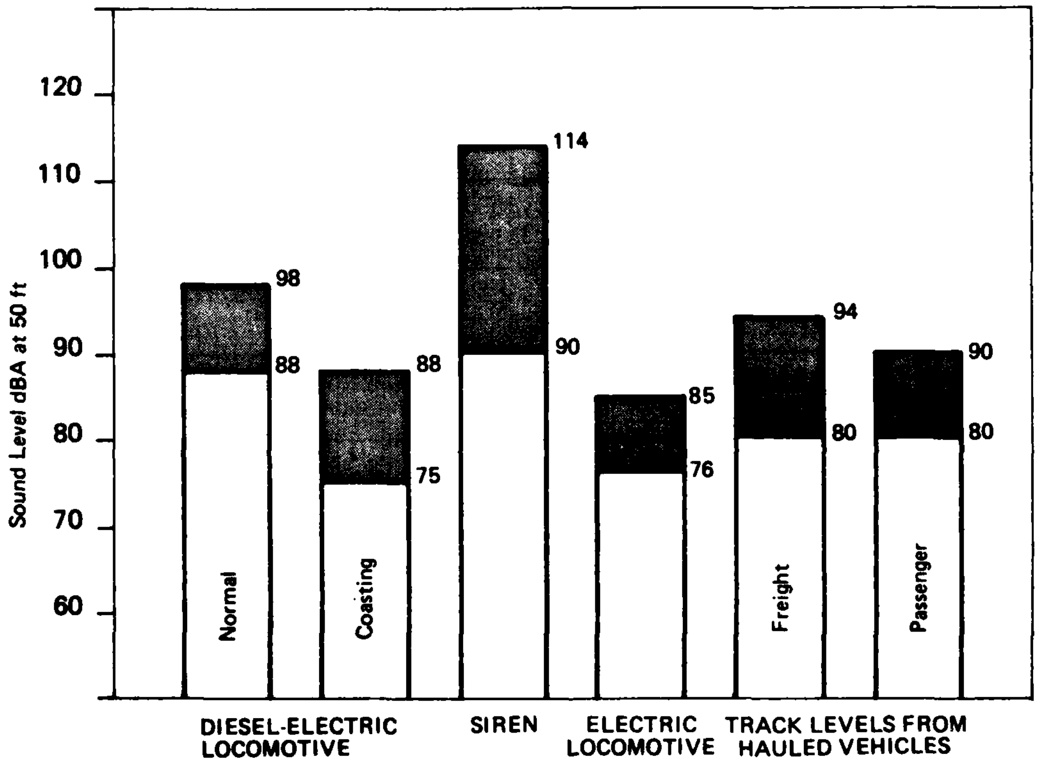
Training activities at Fort Lewis produce annoying intermittent noise. Low-level helicopter flights occur over areas surrounding the post. Artillery fire and demolitions training produce impulse noise that annoys residents of adjacent communities. Levels in excess of 65 dBA do occur in these areas.

2.9.2 Measured Noise Levels

Several noise-sensitive areas surrounding the DuPont site were identified (Crawford, 1977). Areas considered noise sensitive (Class A EDNA) include residential and recreational areas close to the proposed industrial site. These areas are shown in Figure 34 where the noise monitoring was performed. The areas include the Village of DuPont, Hoffman Hill, Nisqually Wildlife Refuge, and Anderson Island. The Washington Department of Ecology also considers the Nisqually Wildlife Refuge to be a sensitive Class A EDNA noise receptor (TRC, 1980).

Traffic noise from Interstate 5 was the dominant source of ambient background noise in all regions except Anderson Island. Maximum noise levels usually occurred from 8 a.m. to 6 p.m. Noise declined gradually after 6 p.m., reaching its lowest level between midnight and 5 a.m. Background levels often varied by as much as 15 dBA due principally to variation in wind direction. Background levels were generally highest under light or southerly wind conditions. Therefore, maximum noise-impact susceptibility for these regions occurs when the wind is from the north and the east, conditions that will minimize background levels and place receiving areas downwind of noise from the proposed export facility.

The shorelines of Anderson Island and the Nisqually Wildlife Refuge have the greatest potential for noise impact from the proposed dock because of the low background noise levels and an unimpeded propagation path.



Source: REPORT TO THE PRESIDENT AND CONGRESS ON NOISE, February, 1972

FIGURE 35
TYPICAL NOISE LEVELS FROM TRAINS

The northeast portion of the wildlife refuge is perhaps most susceptible to increased noise levels because of its proximity to the proposed dock location (approximately one-half mile to its boundary). Minimum ambient levels of 25 to 35 dBA are currently typical for the tip of Anderson Island.

The primary source of intrusive noise in all regions was aircraft, particularly military helicopter overflights. Truck noise was a significant source of intrusive noise in DuPont and the Nisqually Delta. Trains and watercraft were significant sources on Anderson Island.

The range of hourly measurements at each site is summarized in Table G-3 (Appendix G). A comparison of measured existing noise levels to noise criteria is also provided in Table G-4, which lists the number of hours when WAC limits were exceeded at each of the sites while measurements were being made.

Generally, measured noise levels were below the limits of WAC 173-60 for industrial noise impact on residential areas. Upper limits (75 dBA day, 65 dBA night) were occassionally exceeded by transportation services. All measured environments, except those close to Interstate 5, were below the EPA guidelines for protection of public health and welfare (LDN = 55 dBA). All environments were within HUD acceptability limits for new residential construction.

2.10 LIGHT AND GLARE

The only sources of light or glare on the DuPont site are street lighting in the Village of DuPont and lighting of the DuPont Company buildings and wharf. The proposed industrial site is separated from surrounding residential areas by a buffer of trees, at least 1,000 feet in thickness (Figure 26).

2.11 RISK

2.11.1 DuPont Site

Until 1979, the site was used for the manufacture, storage and shipment of explosives. In 1980, the area was cleaned up, this included burning all of the wooden buildings that were previously used for the storage of explosives. As a result of these actions, the risk of an explosion or the release of hazardous emissions has been eliminated.

2.11.2 Oil Spills in Southern Puget Sound

The risk of oil spills in Southern Puget Sound from point and nonpoint sources was assessed by the Oceanographic Institute of Washington in 1980. Their estimated total annual spillage into the terrestrial and marine environment is 3,132 barrels per year. Existing oil sources and their contributions to annual oil spillage in southern Puget Sound are shown in Table 10. Urban runoff and wastewater account for 98 percent of the oil input.

TABLE 10

EXISTING BASELINE OIL SPILLAGE RISK FROM ALL SOURCES
AROUND SOUTHERN PUGET SOUND

Source of Oil Input	Annual Spillage (Barrels per year)
Freighters	0.03
Tankers	
In Transit	0[1]
At Berth	0[1]
Storage Tanks	14
Pipelines	6
Tank Barges	14
Other Vessels	1
Land Sources	
Coastal Refineries	0[2]
Wastewater	2,050
Urban Runoff	1,028
Marine and Land Transportation Facilities	19
All Sources	3,132

[1] There are no tanker port calls in the Nisqually Delta area.

[2] There are no refineries in the Nisqually Delta area.

Source: OIW, 1980

2.12 POPULATION AND EMPLOYMENT

Secondary impacts of the proposed project include changes in population and employment levels. To view such changes in perspective, current levels and trends must be known. The following discussion focuses on population, then on employment.

From a long-range perspective, the four counties in the southeastern Puget Sound region (King, Pierce, Thurston, and Snohomish) have been gaining an increasingly large percentage of the state's population. Although the population growth rate in this region declined during the economic recession of the late 1960s and early 1970s, the decrease was only temporary.

Of these four counties, Thurston County had the highest rate of population growth from 1970 to 1977, 31.3 percent. Pierce County grew by only 2.0 percent for this same period. The City of DuPont grew by 29 percent, reaching a total of 495, people while the neighboring City of Steilacoom grew by 61 percent, from 2,850 to 4,600 people.

The rapid growth in Thurston County since 1970 is due to continuing growth in state employment. Pierce County lost population in the early 1970s because of aerospace layoffs, the economic recession, and reduction of military personnel following the Viet Nam conflict. Subsequently, Pierce County has regained the lost population. The City of DuPont's population growth was due mainly to annexation of an adjacent unincorporated area known as El Rancho Madrona Estates (29 homes) and the construction of an apartment complex in town. The proximity of the City of DuPont to military bases attracts military personnel as residents. The City of Steilacoom added a significant population due partially to annexations, but mainly to its inherent small-town desirability, proximity to military bases, availability of platted lots, and an operating sewer system with available capacity for new residences.

Many of those who moved to Thurston County since 1970 reside in the northeastern portion near Lacey. Much of the anticipated population growth from 1977 to 1987 in Thurston County (up an additional 17-36 percent) is expected in the semi-rural northeastern section.

Pierce County's ten-year projected growth (16-28 percent) is also expected mainly in outlying suburban and rural communites. The only area for additional residents to locate in DuPont is in the 23-lot development of DuPont Terrace.

Pierce and Thurston Counties differ not only in population and rate of growth, but also in major types of employment and unemployment rates. Thurston County has 44.1 percent of its workers employed in state and local government, whereas Pierce County has a more diversified employment base with manufacturing and military installations supplying many jobs. Within Pierce County, dependence on military employment has decreased as the military-personnel level has stabilized. Other types of employment have increased.

The employment base for Steilacoom revolves mainly around the Boise Cascade Paper Mill, and the Tacoma Narrows Historical School District. Many residents of the City of DuPont are retired persons previously associated with the military or the DuPont Company. Fort Lewis is now the only significant employer in the immediate area.

During the 1960s, the DuPont Company employed from 130 to 160 people. In 1971, employment at the powder company peaked at 250 then declined to 150 until March 1976, when operations stopped.

The Thurston County unemployment rate has been consistently lower than that of Pierce County. Employment opportunities in the Puget Sound region are expected to grow due to the Trident Naval Base in Kitsap County, increased activity in Alaska, and an increase in non-manufacturing jobs.

The economy of the Puget Sound region has historically been related to the aerospace and forest-products industries. Moderate growth in both industries is anticipated; however, the forest-products industry will require fewer employees as mechanization increases. Nevertheless, as basic employment sources, lumber and wood products will remain crucial to the regional economy. A recent study of interindustry linkages within the Washington State economy shows that for every million dollars worth of product sold by the logging, plywood, and sawmill industries, from $680,000 to $720,000 of salaries or wages are supported from direct and indirect employment.

For a more extensive discussion of population and employment from which these highlights were taken, refer to the DuPont Export Facility Socio-Economic Impact Study (URS, 1978) prepared for this environmental impact statement.

2.13 HOUSING

As with population and employment data, information on present and projected housing supplies near the proposed facility is needed to assess potential secondary impacts.

Several trends in available housing are apparent in the southern Puget Sound region. Although multi-family housing now constitutes an increasing proportion of housing construction, single-family dwellings make up over 75 percent of the available housing stock. Residential construction has been concentrated in nonmetropolitan areas. Migration of upper- and middle-class households to outlying communities is continuing. Vacancy rates have been declining with continuing population growth. Declines in average household size (number of persons per residence) continue.

During Thurston County's recent period of rapid population growth (1970 to 1975), available housing units increased by 34 percent. Available housing stock in Pierce County increased more slowly in the same period (14 percent), reflecting the slower growth rate in that county. During this

period, housing stock in Steilacoom increased by 765 units from 1006 units. From 1970 to 1977, housing units in DuPont increased by 87 to 217. These 87 units include the 29 houses in the recently annexed El Rancho Estates plat.

Growth pressures in Thurston County, Steilacoom, and DuPont are reflected in low vacancy rates. Thurston County has a vacancy rate of two percent; DuPont and Steilacoom have vacancy rates of only 1.1 percent and 1.0 percent per year. DuPont and Steilacoom are particularly attractive to new residents because of their proximity to the bordering military installations and their rural/suburban setting. The vacancy rate of Pierce County is reported as 5.9 percent per year, a rate that is still considered low.

Median costs for buying a house in DuPont or Steilacoom in 1978 were comparable ($22,000 and $21,000, respectively). The median contract rent varies from $185.00 per month in DuPont to $110.00 per month in Steilacoom. The median cost for buying a house in DuPont in 1981 has increased to $36,000 (URS, 1981). This increase reflects trends in housing prices throughout the state.

For a more extensive discussion of housing, refer to the DuPont Export Facility Socio-Economic Impact Study (URS, 1978).

2.14 TRANSPORTATION/CIRCULATION

2.14.1 Highway Transportation

The highway network serving the southeastern Puget Sound region is shown on Figure 36. Interstate 5 is the major north-south freeway corridor in Western Washington and the major highway corridor serving the western coast of the United States from Mexico to Canada. Interstate 5 provides direct regional connections from the proposed site to Tacoma and Seattle to the north and Olympia and Portland to the south.

Access to the DuPont vicinity is provided by SRs 512, 510 and 16. The state highway department plans to improve SR 16 to provide a complete access facility from Interstate 5 in Tacoma to the Tacoma Narrows Bridge. Construction is expected to begin in five to six years. The state highway department has no other plans for improvements in this region within the current six-year planning cycle.

The 1976 traffic volumes on the regional access system serving the proposed site are also shown on Figure 36. In the vicinity of the DuPont interchange, the average daily traffic (ADT) volume on Interstate 5 was approximately 53,800 vehicles per day. Bus and truck traffic constituted 13 percent of this traffic (Washington State Highway Commission, Department of Highways, 1976).

The local-access highway network is shown on Figure 37. Barksdale Avenue, the main street of DuPont, is a two-lane local-business and residential access. The ADT on Barksdale Avenue in downtown DuPont is 2,000 vehicles per day. This volume is well within the capacity of the street.

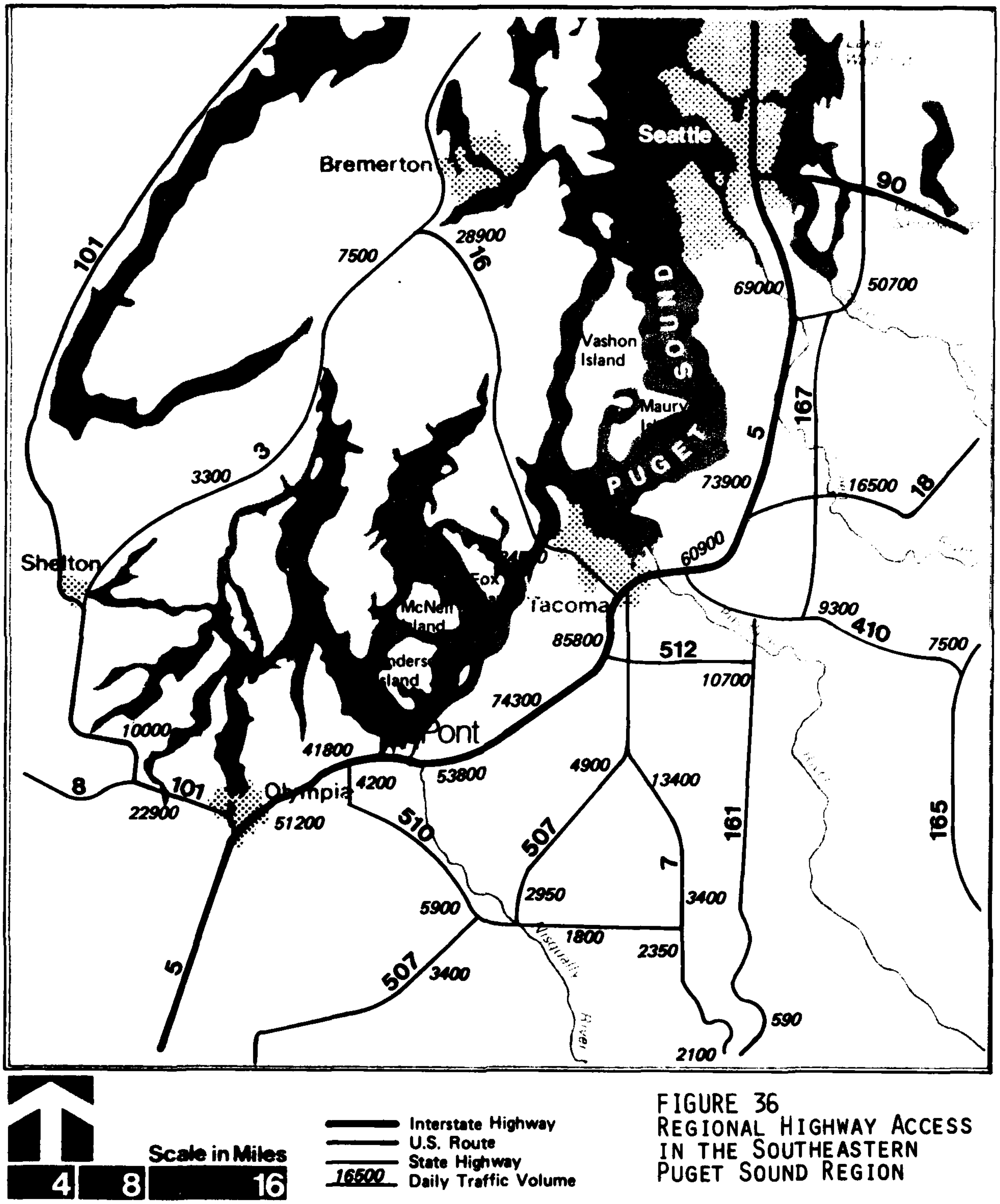


FIGURE 36
REGIONAL HIGHWAY ACCESS
IN THE SOUTHEASTERN
PUGET SOUND REGION

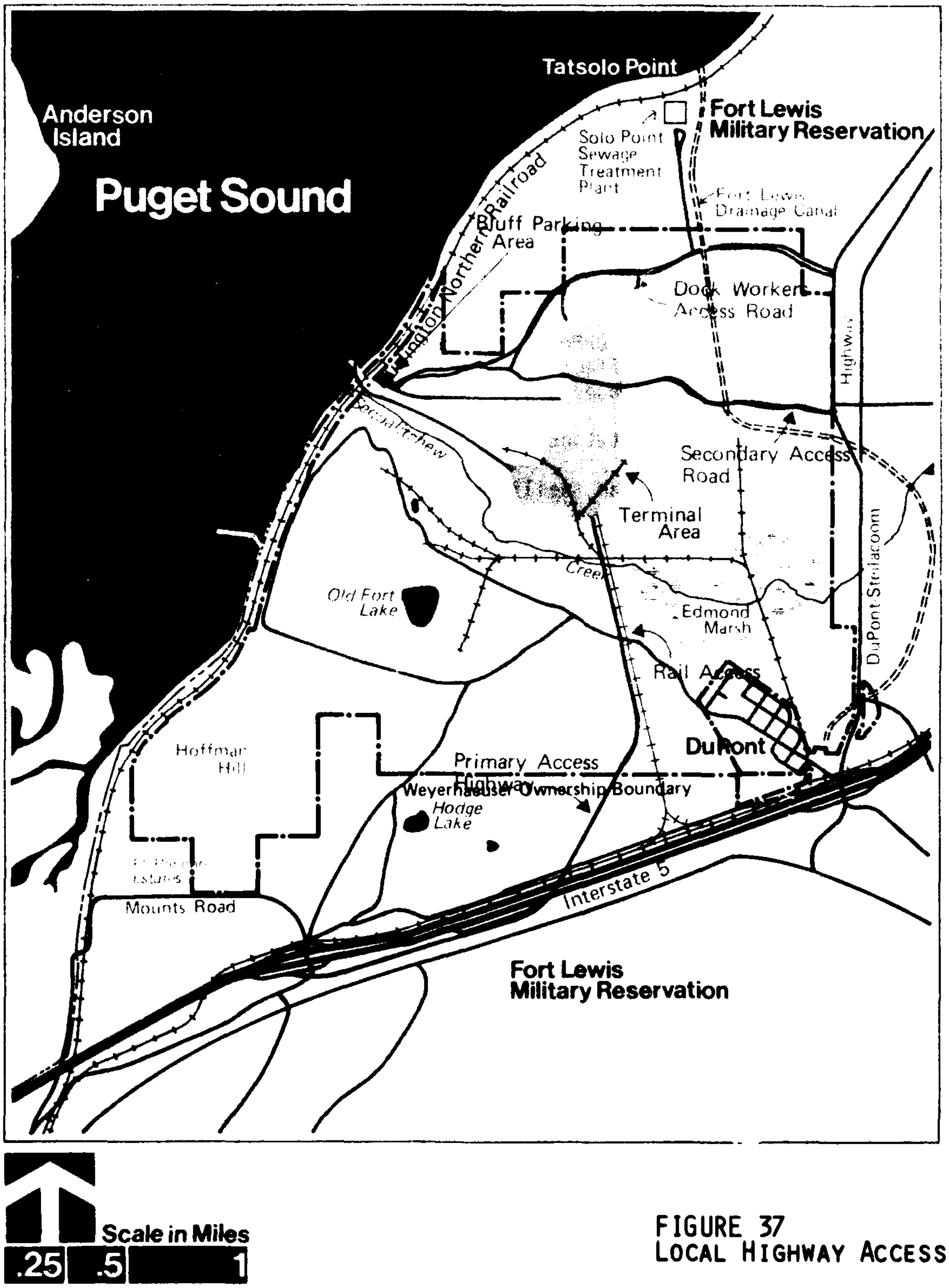


FIGURE 37
LOCAL HIGHWAY ACCESS

The DuPont-Steilacoom Road serves primarily as a direct connection from Interstate 5 to Steilacoom. Some of the traffic on the road is destined for Fort Lewis. The 1976 ADT on the DuPont-Steilacoom Road south of the Steilacoom city limits was 3,300 vehicles per day. The 1977 ADT on the DuPont-Steilacoom Road north of Barksdale Avenue was 5,600 vehicles per day. These volumes are about 50 percent of the capacity of this roadway. Hence no operational problems presently occur along that route.

Mounts Road, located north of Interstate 5 and west of the proposed site, is a local-access road serving a small subdivision and a golf course. Traffic volumes on Mounts Road are minor, and there are no operational problems at this time.

Neither the City of DuPont nor Pierce County has plans for street improvements that will affect the level of service provided by roadway facilities near the proposed site.

2.14.2 Railroad Transportation

The existing railroad facilities in the vicinity of the proposed project are shown on Figure 37. All railroad facilities in the vicinity are now owned by Burlington-Northern Company; the Union Pacific Railroad has operating rights on these lines. The rail line along the waterfront serves as a mainline for both the Burlington-Northern and the Union Pacific. Railroad traffic on the main line averages six passenger trains and 24 to 30 freight trains per day. The line adjacent to Interstate 5 is used by several trains per day. This line provides a continuous connection from Tacoma to Nisqually and can function as a detour in the event of disruption to the line along the waterfront.

2.14.3 Marine Transportation

The DuPont site is adjacent to the Nisqually Reach, which is used by few commercial vessels bound to and from Olympia and Shelton. The United States Coast Guard Vessel Traffic Control Department reports that typical traffic through the area is currently three to 12 vessels per day. The vessel traffic system does not cover areas south of Tacoma.

Shipping activity of the DuPont Company during the 1960s and early 1970s averaged 29 port calls per year. Eighty percent of the port calls were for shipments containing explosives and required a special escort. Ships up to 605 feet long were used for this purpose. In addition to shipments of explosives, four shipments of oil (about 5000 barrels) were received each year (Thut, 1979).

2.15 PUBLIC SERVICES

Industrial development often requires additional public services or increased costs for public services. If substantial population growth results from the project, demand for public services is also increased.

To assess these impacts, knowledge of existing systems and their service capacities is needed. Data on fire protection, police protection, schools, maintenance and medical facilities, and parks and recreation are summarized here. More detail is available in the DuPont Export Facility Socio-Economic Impact Study (URS, 1978).

2.15.1 Fire Protection

Fire protection in Pierce and Thurston Counties is provided by two local communities, two county fire districts, and two other agencies. Characteristics of the four local fire districts or departments are listed in Table 11. Service areas are shown in Figure 38. Other fire protection services in the region include the Washington State Department of Natural Resources, which assists in fires on forested lands, and the military system, which has jurisdiction at Fort Lewis.

The City of DuPont has a mutual aid agreement with Fort Lewis for fire protection and is assisted in firefighting on forested areas within the city by the Washington State Department of Natural Resources.

The DuPont Company has permitted cattle to graze on some of the grasslands, which has kept brush down and reduced fire hazards. Since taking possession of the site Weyerhaeuser Company has intermittently maintained this practice.

A continual fire hazard comes from trains operating along the shoreline. In the past, sparks from trains have started fires in trees along the track.

2.15.2 Police Protection

Police protection in Pierce and Thurston Counties is provided by county sheriff departments in all the nonmilitary unincorporated areas and by police departments of DuPont, Steilacoom, and Lacey within their respective city borders. Fort Lewis, including land leased from Weyerhaeuser, is patrolled by military police. The industrial portion of DuPont is patrolled by a private security force. Table 12 describes the public police services in the region.

2.15.3 Schools

The region surrounding the City of DuPont is served by four school districts--two in north Thurston County and two in west Pierce County. Financial characteristics of the four districts are given in Table 13; enrollment and capacity figures are shown in Table 14. As Table 14 shows, all are operating at levels exceeding capacity.

2.15.4 Maintenance of City Facilities

Maintenance of streets and public facilities within the residential area of DuPont is provided by the city's crew, which is operating near peak capacity. No maintenance services are provided by the city to the 3,200-acre industrial portion of the city (Jackson, 1977).

TABLE 11

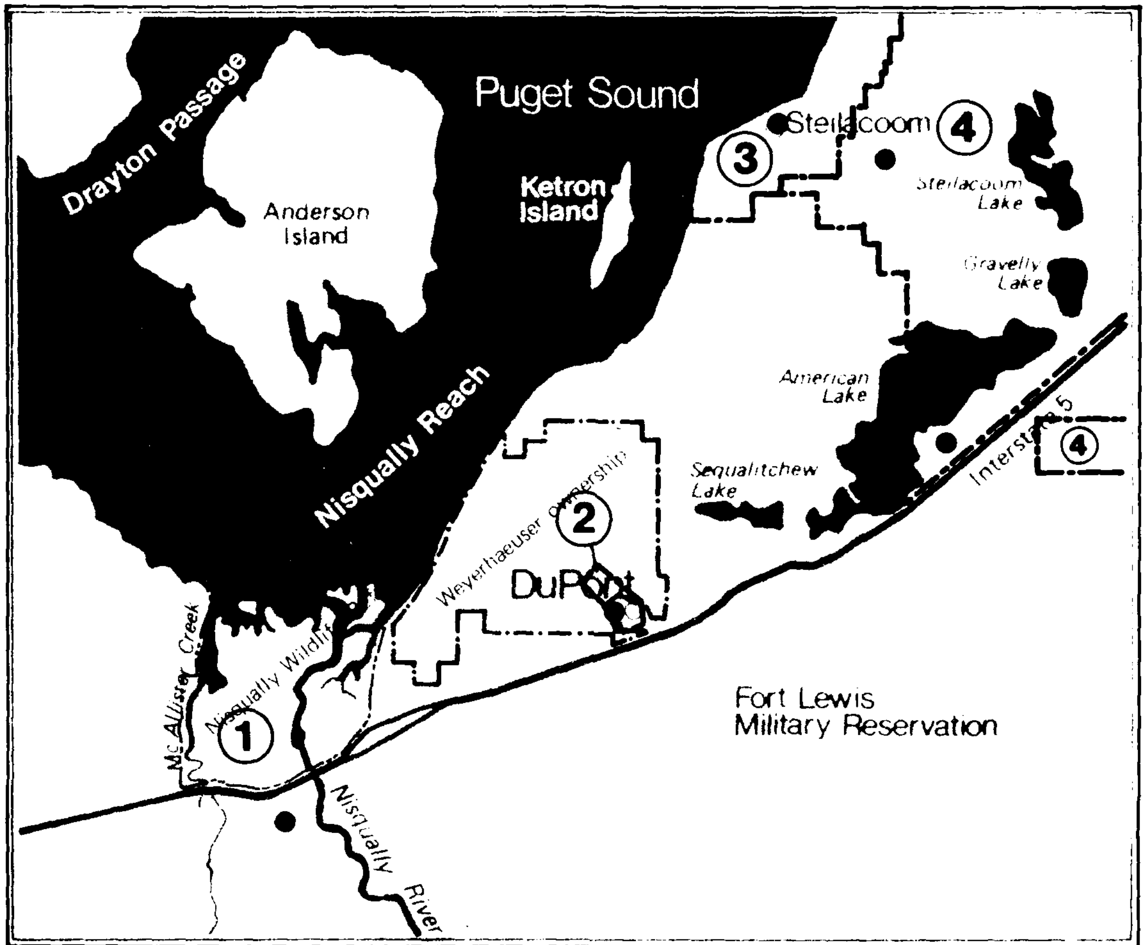
FIRE PROTECTIVE SERVICES FOR DISTRICTS WITHIN
PIERCE AND THURSTON COUNTIES

1976

	Jurisdiction			
Characteristic	Lacey No. 3	Lakewood No. 2	Steilacoom	DuPont*
Full-time Paid Personnel	34	39	0	1
Volunteer Personnel	50	30	28	12
Number of Firefighting Vehicles	10	7	3	1
Fire Protection Classification	5 and 6	4	6	8

*The City of DuPont has not increased the numbers of full-time paid fire personnel, volunteer personnel, or firefighting vehicles since 1977. However, the city's fire protection class improved to a rating of 7 following reevaluation (Mark Jackson, personal communication, 1981).

Source: Dick, Carol, 1977. Secretary, Lakewood Fire District No. 2, Tacoma, Washington, Personal Communication, July 8; Pugh, Floyd M., 1977. Chief, Lacey Fire District No. 3, Lacey, Washington, Correspondence received June 28; Jackson, Mark, 1977. Environmental Administrator, City of DuPont, Copy of Correspondence addressed to URS Company, dated June 10, 1977.



Scale in Miles

1 5

Legend

- Fire Protection District Boundary
- ● Fire Stations
- ② Fire Protection District

1. Thurston County Fire Protection District Number 3
2. City of DuPont Fire Department
3. Steilacoom Fire Department
4. Pierce County Fire Protection District Number 2

FIGURE 38
FIRE DISTRICT SERVICE AREAS

Sources:
Chief Floyd M. Pugh, Lacey Fire District No 3
Mr. Patrick Burden, Dames & More, Seattle, June 27 and July 7, 1977
Carol A. Dick, Pierce County Fire Protection District No. 2

TABLE 12

POLICE PROTECTIVE SERVICES IN
PIERCE AND THURSTON COUNTIES

	Jurisdiction				
Characteristic	Pierce County	DuPont[b]	Steilacoom	Thurston County	Lacey
Number of Full-time Officers with Arrest Authority	125	1	7	57	24
Reserve Officers With Arrest Authority[a]	32	0	7	50	8
Total Number of Officers With Arrest Authority	157	1	14	107	32
Total Budget	$3,842,988	$16,386	$115,434	$943,737	$525,041
Client Population	209,931	562	4,600	40,076	11,860

[a]Includes both part-time and volunteer personnel.

[b]The City of DuPont has added a part-time officer with arrest authority to the police force (increasing the number of officers with arrest authority to 2 persons) since 1977. The total budget for 1981 is $34,854 (Mark Jackson, personal communication, 1981).

Source: Washington State 1976 Law Enforcement Survey, Office of the Attorney General; Jackson, Mark, 1977, Environmental Administrator, City of DuPont, Copy of Correspondence addressed to URS Company, dated June 10, 1977; Clark, Dennis, 1977, Town Planner, Town of Steilacoom, Correspondence received June 30, 1977; Jackson, Mark, 1977, personal communication.

TABLE 13

FINANCIAL CHARACTERISTICS OF SELECTED SCHOOL DISTRICTS IN PIERCE AND THURSTON COUNTIES

Characteristic	School District: Pierce County: Clover Park	School District: Pierce County: Steilacoom Historical	School District: Thurston County: Olympia	School District: Thurston County: North Thurston
Average Annual Enrollment (1975-1976)	16,529	924*	7,028	6,714
Total Expenditure (1975-1976)	$27,147,572	$1,146,590	$12,086,430	$9,798,004
Expenditure Per Pupil	$1,642	$1,240	1,720	1,459
Total Revenues				
(1975-1976)	$26,952,981	$1,177,220	$11,806,242	$9,729,403
Local Taxes (percent)	12.33	16.59	32.28	31.07
County Administration Funds (percent)	2.50	3.22	3.74	4.34
State Funds (percent)	58.01	54.01	53.66	56.13
Federal Funds (percent)	17.66	18.55	4.04	3.76
Other (percent)	9.50	7.63	6.28	4.70
Number of Certificated Staff (1976-1977)	764	43	428	412
Average Salary	$17,262	$ 13,925	$ 16,592	$ 16,355

*The expected enrollment in the Steilacoom Historical School District, which serves DuPont, is about 1,300 students for the 1981-1982 school year (Marian Feoster, personal communication, 1981).

Source: Superintendent of Public Instruction, Bulletin No. 13-77, March 1977; and Bulleting No. 17-77, April 1977.

TABLE 14

ENROLLMENTS[a] AND CAPACITIES OF SELECTED SCHOOL DISTRICTS IN PIERCE AND THURSTON COUNTIES

District	1972	1973	1974	1975	1976	Current Capacity
Clover Park	13,805	15,042	14,767	14,498	14,018	12,855
Steilacoom Historical[b]	825	853	958	978	985	925
Olympia	7,338	7,224	7,243	7,316	6,913	7,097
North Thurston	6,816	7,094	7,089	7,026	7,269	5,988

[a]Clover Park and Steilacoom Historical enrollment figures are average annual enrollment for the school year beginning in the year designated. Olympia and North Thurston enrollment figures are for October each year.

[b]The expected enrollment in the Steilacoom Historical School District is about 1,300 students for the 1981-1982 school year. The enrollment capacity for the school district is aqpproximately 1,600 students (Marian Feoster, personal communication, 1981).

Sources: Chatterton, James, Personal Communication, September 1, 1977. Hartman, Dr. Jess, and Dick Woll, Personal Communication, September 1, 1977. Educational Services District, 113 School Enrollment, Annual figures. Wilson, Righard, Correspondence to Dames and Moore, July 11, 1977. Ware, William C., Correspondence to Dames and Moore, July 13, 1977.

2.15.5 Medical Facilities

Medical facilities in Pierce and Thurston Counties are located in major population areas. Hospitals in the area have unused capacity; however, many nursing homes are full or nearly full.

There are no medical facilities within the City of DuPont. The nearest civilian hospitals are Lakewood General Hospital in Lakewood (eight miles) and St. Peter Hospital in Olympia (12 miles). Madigan Army Medical Center at Fort Lewis provides medical care to active and retired military personnel and dependents.

Emergency transportation from DuPont to these facilities can be provided by the Steilacoom Fire Department rescue unit or the Lakewood Pacific Ambulance Company. In addition, the Madigan Army Medical Center ambulance service will provide emergency ambulance services to residents of surrounding communities, including DuPont.

2.15.6 Parks and Recreation

Numerous parks in the region provide facilities for outdoor recreation. Many of these are located on Puget Sound or on small lakes in the Puget lowlands. Major recreational resources within a two-hour drive of DuPont include Mount Rainier National Park, Olympic National Park and Forest, and the Snoqualamie National Forest.

Only two small parks have been developed in DuPont, a 1.5-acre playground and a 0.8-acre arboretum. Development as a park of a 23-acre parcel southeast of the Village of DuPont is planned.

Much of the shoreline adjacent to the DuPont site is controlled or owned by Burlington-Northern Railroad and the U.S. Fish and Wildlife Service. Weyerhaeuser owns about 5700 feet of the tidelands, and needs an easement from Burlington-Northern for access.

The Nisqually Reach supports a variety of types of marine-oriented recreation. The Washington Marine Atlas (Washington Dept. of Natural Resources, 1975) shows the DuPont shoreline and the outer Nisqually Delta to be areas of significant sea run cutthroat and steelhead fishing. The western portion of the Reach supports fishable shrimp concentrations. The Nisqually Reach in the vicinity of the Delta is a popular salmon fishing area, especially off the mudflats and across the Reach, off the southern tip of Anderson Island. Pacific oysters occur throughout the Delta. Although the only significant geoduck concentrations shown by the atlas are along the western portion of the Nisqually Reach (northwest of the Delta) baseline investigations carried out during the preparation of the state EIS indicate substantial concentrations of geoducks from the subtidal portions of the Delta to the vicinity of the present dock at DuPont (Dames and Moore, 1978). Extensive beds of intertidal hardshell clams are found in Oro Bay, across the Reach from DuPont.

Several parks and recreation areas are located along the shoreline of the Nisqually Reach. Tolmie State Park is located five miles west of the DuPont site, on the other side of the Nisqually Delta. The 105 acre park features wooded areas, a beach and an artificial reef which is a popular scuba diving area. Recreational attractions include clamming, beachcombing, skin diving, fishing and picnicking. Kitchen facilities are provided in the picnic areas. Since 1972 the visitor totals have increased from 82,000 to over 160,000.

The Nisqually Wildlife Refuge, adjacent to DuPont, provides opportunities for commercial and sports fishing (both Indian and non-Indian), hunting, boating, bird watching, environmental education and nature observation. Much of the Refuge was originally farmland dating back to the early 1800's. The Refuge was established in 1974.

Of the 3,690 acres of Refuge lands, 2,000 are privately owned. The rest are owned by the U.S. Fish and Wildlife Service, which plans acquisition or condemnation of more lands. Both recreation and preservation are major purposes of the Refuge. The Refuge is open to daily use only and has a number of trails for exploration. Attendance figures for 1977, 1978 and 1979 are respectively 10,090, 7,078 and 8,863. Fishing and wildlife observation account for well over half of the activity in the Refuge. Peak visitation is in the spring and summer.

In the vicinity of Steilacoom, nine miles northeast of DuPont, are two small city beaches. Sunnyside Beach is 3 acres and Salter Beach is 1 acre.

A number of boat launches are located along the Nisqually Reach. They include Steilacoom, Ketron Island, Luke's Landing (near the mouth of McAllister Creek), and several on Johnson Point at the northwest end of the beach. Oro Bay, on Anderson Island, is a popular anchorage. The most intensive recreational fishing in the area is at Lyle Point, off the southern tip of Anderson Island. Salmon is the primary fish sought here. More information on fishing can be found in Section 2.8.9.

2.16 UTILITIES AND ENERGY

Information about utilities and energy in the DuPont vicinity is discussed briefly here. For more detail, the reader is referred to the DuPont Export Facility Socio-Economic Impact Study (URS, 1978).

2.16.1 Communications

Pacific Northwest Bell Company provides telephone service to the southeastern Puget Sound region, including the City of DuPont.

2.16.2 Water

The primary water source of the southeastern Puget Sound region is local groundwaters (Table 15). The only exception is the City of Tacoma, which obtains its water from the Green River; however, when the river is turbulent and muddy, Tacoma supplements this source with groundwater.

TABLE 15

WATER DELIVERY AND CAPABILITY FOR
DUPONT, EL RANCHO MADRONA, FORT LEWIS, STEILACOOM,
AND LAKEWOOD WATER DISTRICTS

(million gallons per day)

	DuPont[c] (Residential)	El Rancho[c] Madrona	Fort Lewis	Steilacoom	Lakewood Water District
Capacity					
Well capability	.58	.14	NA[b]	2.7	21.3
Storage	0.1	--[a]	NA	1.25	3.5
Consumption	.16 to .29	.07	7 to 16.5	.3 to 1.4	7 to 20

[a] 40,000 gallon storage reservoir was developed in 1979.

[b] NA - Not Available.

[c] Mark Jackson, personal communication, 1981.

Sources: Mark Jackson, City of DuPont, Personal Communication, September 1, 1977; Richardson Water Well Company, Personal Communication, September 1, 1977; Mr. Dart, Fort Lewis Utilities, Personal Communication, September 1, 1977; lakewood Unlimited and Pierce County Planning Department, A Comprehensive Planning Study of the Lakes District, 1967; and Dennis Clarke, Town of Steilacoom, Correspondence to Dames and Moore, June 1, 1977.

The Comprehensive Water Supply Study and Plan for Pierce County and Vicinity (Tacoma Department of Public Utilities, 1969) suggested that the local groundwater systems would soon be inadequate and should be supplemented with Tacoma's surface water resources by means of a water-conveyance system from Tacoma to most urbanized parts of the county.

In Thurston County, the city systems are deemed adequate for contemplated future growth. In most rural areas, however, limited supplies of groundwater will restrict major expansion of private or community facilities. Hawks Prairie is the one area in northeast Thurston County where the water supply is adequate to support considerable growth.

2.16.3 Sewer and Stormwater Systems

Much of the southeastern Puget Sound region (south of Tacoma) is dependent on individual or community septic tanks or drainfields.

Olympia, Lacey, and Tumwater share a treatment plant, which has no excess capacity. A new treatment plant has been proposed to serve the projected population in the year 2000.

Sewer systems presently serve Steilacoom, Fort Lewis and DuPont in Pierce County. Steilacoom's system, which serves 7,900 persons, is being upgraded to provide secondary treatment for 11,100 residents. Long range plans are to provide service to 35,000 residents.

The City of DuPont owns and maintains a collection system that connects with the Fort Lewis sewer system. The Fort Lewis treatment plant, located on Puget Sound, has a capacity of 7.0 million gallons per day (MGD) average flow. The average daily flow of 3.5 MGD during the dry months from June to October is increased to about 6.8 MGD during the rainy season by infiltration. The treatment facility violates water quality standards during winter months due to excessive infiltration in the collection system.

Stormwater systems are provided in several of the urbanized areas in the DuPont vicinity. Fort Lewis operates an extensive storm sewer system that drains the developed portion of the military installation. The system discharges into a channel that crosses Sequalitchew Creek and passes through the upland terminal area (Figure 19). In the City of DuPont, stormwater catch basins are located along some streets.

2.16.4 Solid Waste

Solid waste in the region is generally collected by private collection companies and disposed of in county-owned or private sanitary landfill sites.

Solid waste is collected in northeastern Thurston County by the Pacific Disposal Company and taken to the Hawks Prairie landfill. Solid waste in DuPont is collected by the Pierce County Refuse Company and taken to Thun Field. Fort Lewis operates a 140-acre sanitary landfill on lands leased from Weyerhaeuser within the City of DuPont. The site has a lifespan of 15 years and is filled at a rate of 55 to 65 tons per day.

2.16.5 Energy

Two power companies operate in the DuPont vicinity. Tacoma City Light supplies power to Steilacoom, Fort Lewis, McChord AFB, and the Lakeview Light and Power Company Cooperative. Puget Sound Power and Light Company supplies power to the City of DuPont. About 60 percent of the electricity used in the area is marketed by Bonneville Power.

2.17 GOVERNMENTAL FINANCE

A facility of the type proposed by Weyerhaeuser would affect government finances by increasing both revenues and costs. The importance of these increases must be evaluated in the context of the existing situation. Both revenues and costs of the City of DuPont, and of Pierce and Thurston Counties are summarized briefly in this section. More detailed data is available (URS, 1978). Although the socioeconomic study has not been updated (as is the case with the majority of the baseline studies), the relationship between costs and revenues has been spot checked (URS, 1981) to ensure that the relative socioeconomic impacts identified in 1978 would still reflect the potential impacts expected in the area following development of the proposed facility (see Chapter 4 for further discussion).

2.17.1 Revenues

The property tax is the most important local revenue source. In Washington State, property taxes have generated about 35 percent of state and local revenues since 1970. These taxes are particularly crucial to local governments.

Another significant source of local revenue is redistribution of taxes collected by the state (e.g., motor vehicle fuel tax, local sales and use taxes). Business and occupation taxes provide additional revenues for cities. An important revenue source for counties is the real-estate excise tax.

DuPont's major revenue sources are property and business taxes, redistributed revenues, and utility service charges. Since 1973 the amount of total property taxes has increased at an annual rate of six percent. During the same period, land improvements and annexations increased the assessed valuation dramatically (from $1,509,000 to $8,261,000 from 1973 to 1977). The assessed valuation in 1980 for DuPont increased to $17,205,329 (URS, 1981). However, DuPont has the lowest tax rate in the state.

2.17.2 Costs

In general, the major costs borne by county governments in the region are those of providing general governmental administration, statemandated social and health services, law enforcement, and county roads. Major costs for cities are for maintenance of the physical environment, general government, police, and city roads. Support of the school district is a major local government cost.

When the City of DuPont was incorporated, all major utilities were present and operable. Few major expenditures have been required for improvements or services. The only major capital expenditure program of the city is the current upgrading of the water supply system. These improvements were funded mainly by federal grants.

2.18 HUMAN HEALTH

Information concerning medical facilities and emergency transportation available in the DuPont vicinity is discussed above under Public Services.

2.19 AESTHETICS

The DuPont site is part of the shoreline visible from the sound; other portions of the site are visible from the Village of DuPont and various public roads. Hoffman Hill can be seen from the Nisqually Delta, and the entire bluff, the dock, and some of the DuPont buildings are visible from the Nisqually Delta, Interstate 5, Anderson Island and Nisqually Reach (Figure 39). Interstate 5 provides a view of the delta to passing motorists.

Above the railroad line, the bluff bordering Puget Sound is wooded, mostly with evergreens. A portion of the bluff is covered by madrona trees, most of which were killed by fire caused by trains.

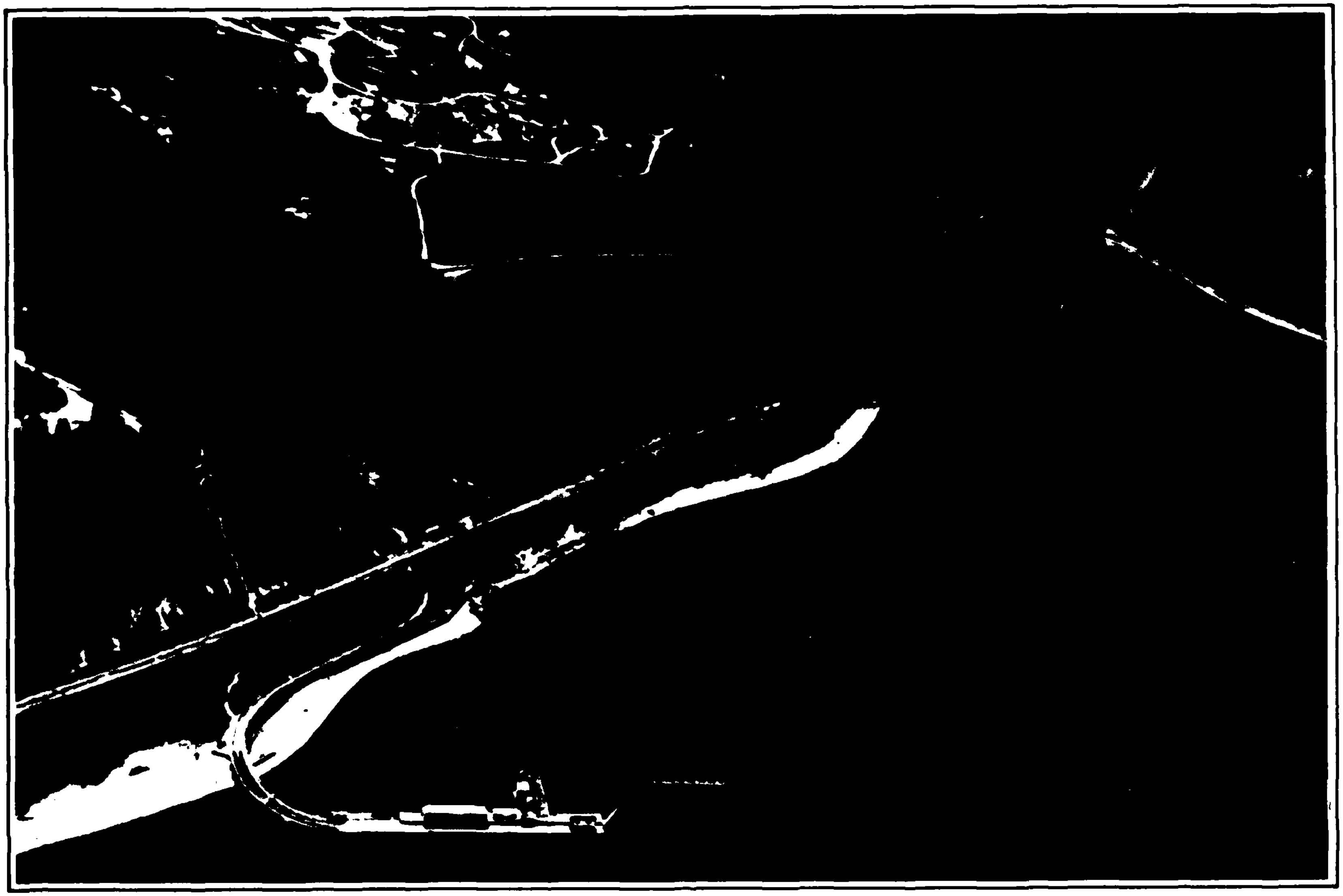
The bluff area, the DuPont Company buildings, and the cleared area that surrounds them, are not particularly attractive (Figure 39); however, the remainder of the site is aesthetically pleasing to viewers from Nisqually Reach, Anderson Island and the Nisqually Delta.

Portions of the site visible from the Village of DuPont are mostly wooded areas (Figure 40). Where the site borders DuPont-Steilacoom Road, wooded and open areas of the site (including the landfill) can be seen.

Old Fort Lake, a lake rimmed by Douglas fir forest, is an interesting feature, especially when waterfowl are present. Wooded areas cover much of the site. The Sequalitchew Creek canyon, with its moss and fern-covered trees above the stream, is aesthetically pleasing. Some of the DuPont Company buildings remaining on the site are stable, while others are deteriorating. A view of the Sound and Anderson Island can be seen from the top of the bluff. See Figure 41 for other views of the site.

2.20 CULTURAL RESOURCES

The DuPont site represents an important archaeological and historical resource in the Puget Sound area. The area was the center of a well-developed Indian culture as well as an important trade center for early British and American settlers. Excavations within the property may yield valuable information about these items.



North

FIGURE 39
AERIAL VIEW OF EXISTING
DOCK
June 1977

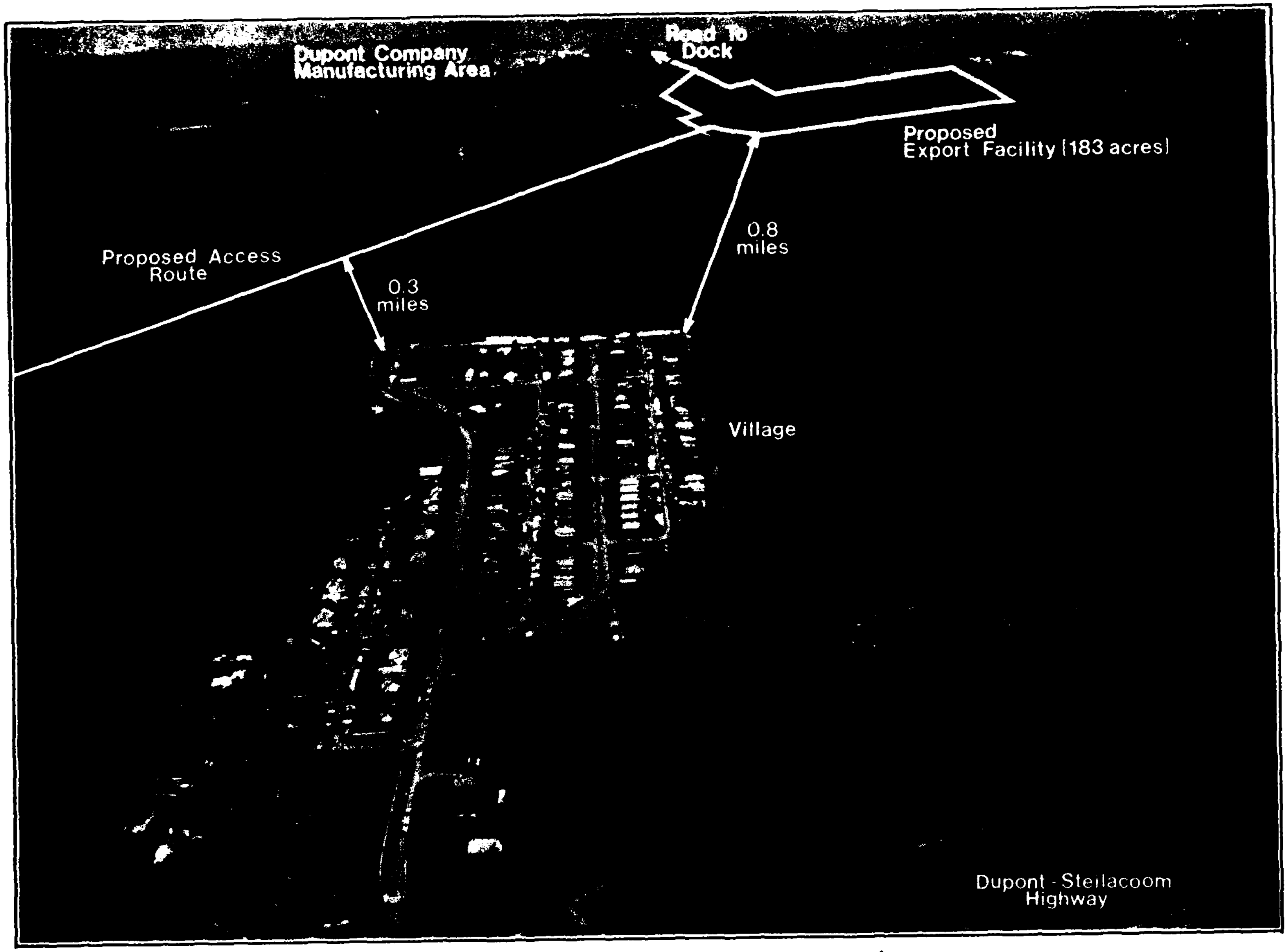


FIGURE 40
AERIAL VIEW OF VILLAGE
OF DUPONT
June 1977

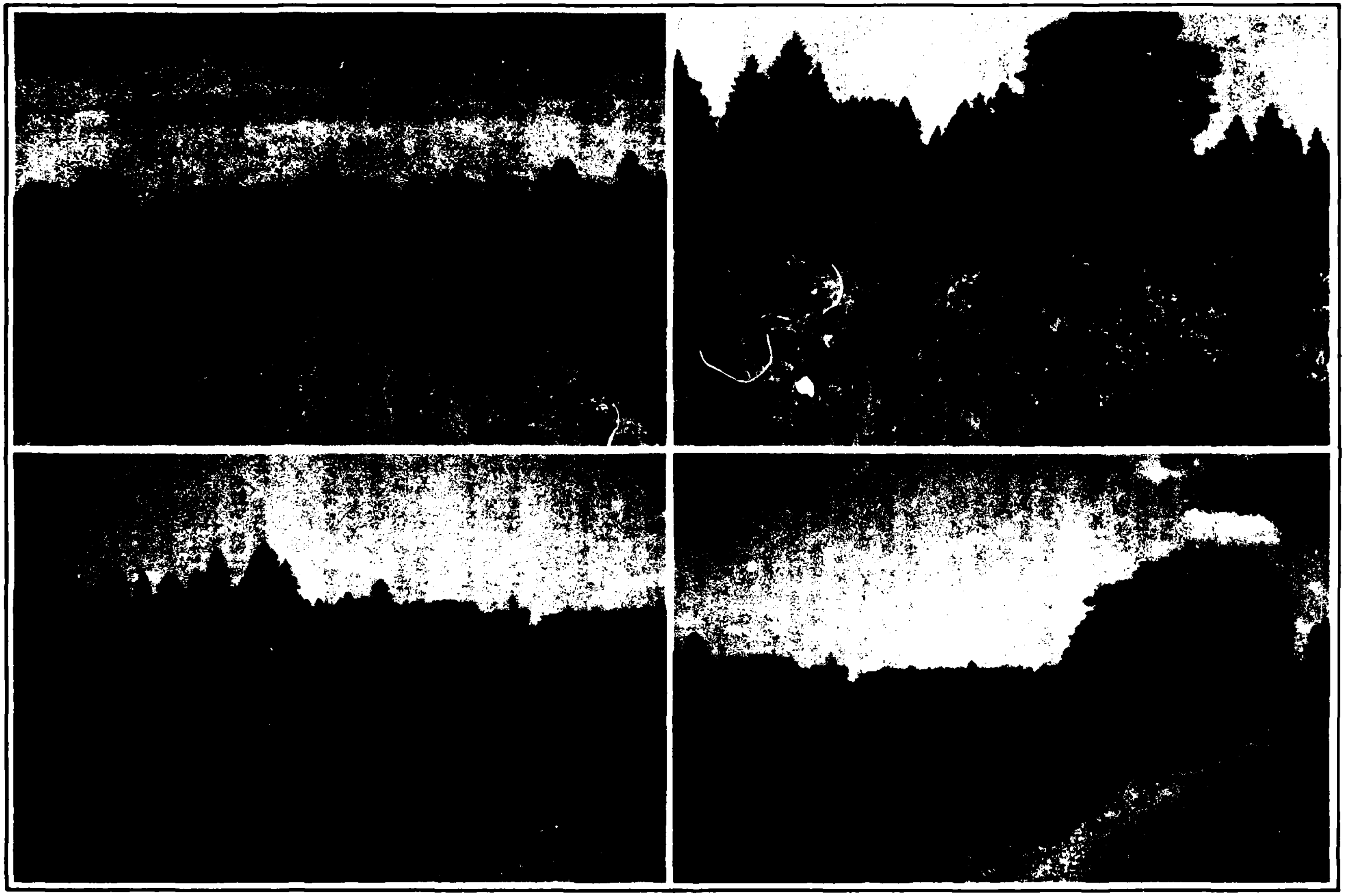


FIGURE 41
AREA TO BE DEVELOPED AS
TERMINAL AREA
June 1977

The DuPont area was the site of a major village of the Nisqually people, whose territory extended along both sides of the Nisqually River and as far inland as Mt. Rainier. Like other Puget Sound groups, the Nisqually followed a hunting-gathering mode of existence, involving a seasonal round of activities including river and marine fishing, hunting, and gathering shellfish and wild plants. As a result of their location, the Nisqually had extensive contact with other peoples from Puget Sound and the interior of Washington. The influence of these contacts on the development of the Nisqually culture is of particular archaeological interest.

The site has a high archaeological potential for several reasons. Its geology, particularly the high permeability of glacial materials, is such that deep surface soils have not developed and land surfaces have remained essentially unchanged since the last glaciation. Therefore, evidence for local human habitation as long as 10,000 years ago could be present.

The topography of the site is unusual in that water levels fall off very steeply along the DuPont shoreline. The lack of coastal sites in southern Puget Sound has been attributed to a substantial rise in water levels in the past 5,000 years (Onat, 1976). Hence, most sites adjacent to deep water at that time are now submerged. In contrast, the mouth of Sequalitchew Creek would be close to deep waters even if the level of Puget Sound were 100 feet lower. Thus, this area may contain sites that would provide information on a shift from the early generalized hunting and gathering culture to a more specialized hunting, gathering and fishing culture that is thought to have occurred about 5,000 years ago.

Specific information about material culture and land use and management is generally available for the area. The DuPont site contains a variety of microenvironments (marine, shoreline, freshwater stream, lakeside, marsh, prairie, forest) likely to have had some specialized use and to contain characteristic artifacts (Onat, 1976).

Although much of the site appears to be undisturbed, construction activities in the early part of the century and activities of artifact hunters have extensively disrupted much of the area.

Table 16 lists archaeological and historical sites identified by the archaeological base study (Onat et al, 1977). The location of several of the sites are either unconfirmed or unknown. It was the policy of the 1977 reconnaissance to create site records for several properties which were not actually located in the field. Historical references or informant accounts were used in such cases.

Although no old maps are known that show the locations of burial grounds or a cemetery associated with Fort Nisqually, historical records have indicated the general locations of several cemeteries. These sites are described by Onat et al. (1977) and listed on Table 16 as sites 23, 24, and 25. Historical records have mentioned that burials of prominent Nisqually Indians and whites associated with the fort occurred in the vicinity of Fort Nisqually, although their locations remain unknown (Huggins, 1833-1859; Anonymous, 1895; Troxel, 1950).

TABLE 16

RECORDED ARCHAEOLOGICAL AND HISTORICAL SITES IN THE DUPONT AREA

Designation		Name	Location* Known	Unconfirmed	Unknown
1.	45-P1-54	Sequalitchew Site (and Nisqually House)	X	(X)	
2.	45-P1-55	1833 Fort Nisqually	X		
3.	45-P1-56	1843 Fort Nisqually	X		
4.	45-P1-57	Men's Boarding House	X		
5.	45-P1-58	Brick Yard Dump		X	
6.	45-P1-59	Old Town Dump	X		
7.	45-P1-60	Edmond Marsh Dump	X		
8.	45-P1-61	Railroad Dump #1	X		
9.	45-P1-62	Railroad Dump #2	X		
10.	45-P1-63	Railroad Dump #3	X		
11.	45-P1-64	Burning Ground Dump	X		
12.	45-P1-65	DuPont Town Dump	X		
13.	45-P1-66	Richmond Mission		X	
14.	45-P1-67	Wilkes Observatory		X	
15.	45-P1-68	Farm Locality	X		
16.	45-P1-69	Town of DuPont	X		
17.	45-P1-70	DuPont Company	X		
18.	45-P1-71	Sawmill			X
19.	45-P1-72	DuPont SW	X		
20.	45-P1-73	Indian Hall			X
21.	45-P1-74	1843 Indian Camp			X
22.	45-P1-75	Crystallizer		X	
23.	45-P1-76	Sequalitchew Graves			X
24.	45-P1-77	Fort Lake Graves			X
25.	45-P1-78	Fort Nisqually Graves			X

*The location of several of the sites are either unconfirmed or unknown. It was the policy of the 1977 reconnaissance to create site records for several properties which were not actually located in the field. Historical references or informant accounts were used in such cases.

It is possible that some burial sites have already been disturbed and lost as a result of earlier activities on the site; others may be discovered as a result of future activity. Burials associated with the period 1830 to 1900 would most likely be in good condition. Also, a possibility exists that other historical documentation may be discovered that would bear light on burial locations on the DuPont site.

Detailed information on the archaeological sites is available to those with a need to know. Information on location of archaeological sites is exempt from disclosure under state and federal law. (RCW 27.53. 0020-.090

and PL 94-458). Once these sites are identified, there tends to be an increase in the public searching the site for memorabilia for their own use. These historical and archaeological artifacts must be protected.

The Nisqually Delta was one of the areas of early settlement of the Puget Sound region by Europeans. Hence, the surrounding region is comparatively rich in historic sites. One of the historical sites, the 1833 Fort Nisqually site, is currently listed in the National Register of Historical Places. More detailed information concerning historical sites is presented in Onat, (1977) and in Stratton and Lindeman, (1977).

This brief chronology of historical events references many of the sites listed in Table 16.

CHRONOLOGY OF HISTORICAL EVENTS

1832- A cabin later called Nisqually House, was established at the mouth of the Sequalitchew Creek by Hudson's Bay Companys traders to collect furs from the local Indians.

1833- Fort Nisqually was built. It consisted of a stockade and buildings, and soon became main supply center for Indians and early American settlers in the lower Puget Sound area.

1840- The Methodist Episcopal Mission House was established by Dr. John P. Richmond, an American missionary. The first Fourth of July celebration west of the Mississippi River may have been held at this location.

1841- The Wilkes Observatory was established above Puget Sound south of Sequalitchew Creek. The observatory operated less than one year.

1843- Fort Nisqually was relocated to provide more space and a better water supply (Figure 42). Much of this fort is reconstructed at Point Defiance Park in Tacoma.

1869- The U.S. government paid the Hudson's Bay Company for land rights granted under the Oregon Treaty of 1846. The fort ceased to operate and Edward Huggins, the last factor at the fort, became a U.S. citizen. He homesteaded near the fort until the property was bought by DuPont Company.

1906- DuPont Company bought the property now incorporated as the City of DuPont and began construction of its munitions plant. A construction camp called Old Town was located at the 1843 Fort Nisqually site.

1909- The DuPont Munitions Plant was completed.

1909-1917 - A town, DuPont, was built by the company for the permanent employees of the DuPont plant. One hundred houses had been completed by 1917.

1934- The Factor's house and granary were moved to Point Defiance Park.

1951- The Town of DuPont was incorporated.

1971- The town annexed 3,200 acres owned by DuPont Company.

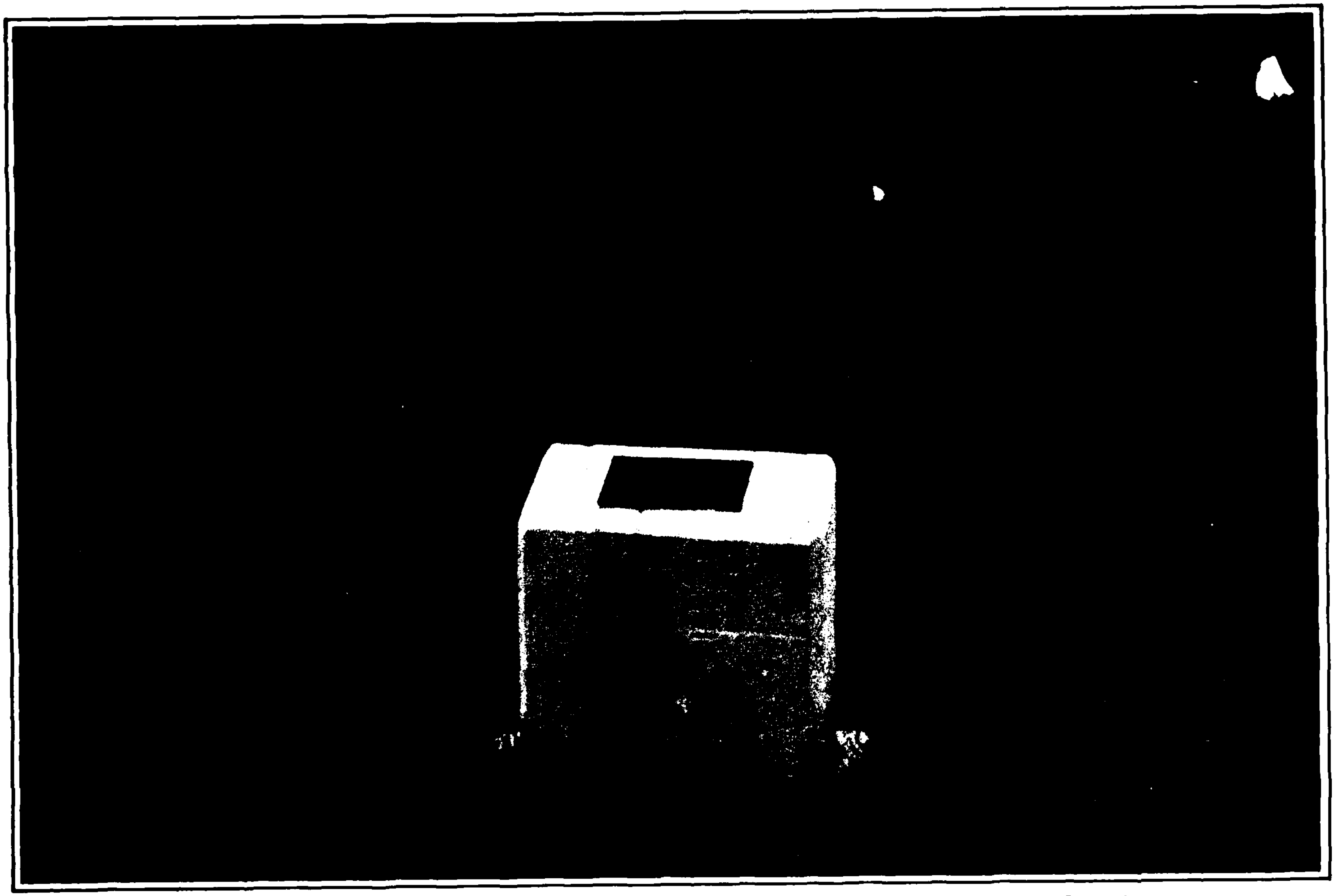


FIGURE 42
1843 FORT NISQUALLY
SITE July 1978

3.0 Relationship of the Proposed Action to Land Use Plans and Policies

3.1 LAND-USE PLANS AND POLICIES

Various regional and local land use plans have been adopted for each area at or near the proposed facility since a variety of governmental agencies have jurisdiction. Such plans include shoreline plans, comprehensive land use plans, and regional plans.

Historic land use on the site has been industrial, although much of the site is undeveloped and is a wildlife habitat and buffer for the neighboring wildlife refuge. A portion of the DuPont shoreline is classified urban, the remainder as conservancy. The mainline track of the Burlington Northern railroad runs along the border of the sound. Another track parallels Interstate 5. Institutional use associated with Fort Lewis (military training and housing) dominates most of the surrounding area.

Jurisdictions for land use and planning for the site and lands surrounding it are shown in Figures 43 and 44. The City of DuPont has jurisdiction over the site. The Washington State Department of Natural Resources has jurisdiction over the beds of navigable waters adjacent to the site, while the U.S. Army Corps of Engineers has jurisdiction over work in these navigable waters and their adjacent wetlands. Land use surrounding the DuPont site is under the jurisdiction of Pierce County, the U.S. Department of the Interior (Nisqually Wildlife Refuge), and the U.S. Army.

3.1.1 Shoreline Management Act of 1971

The Shorelines Management Act of 1971 (RCW 90.58) defines several areas as "Shorelines of Statewide Significance". One of these is the Nisqually Delta, from DeWolf Bight, west of the Delta, to Tatsolo Point, north of the DuPont boundary. The definition includes all land seaward of the ordinary high water mark and all lands shoreward for 200 feet. Hence, the entire shoreline along the project site is a "Shoreline of Statewide Significance" (Figure 45).

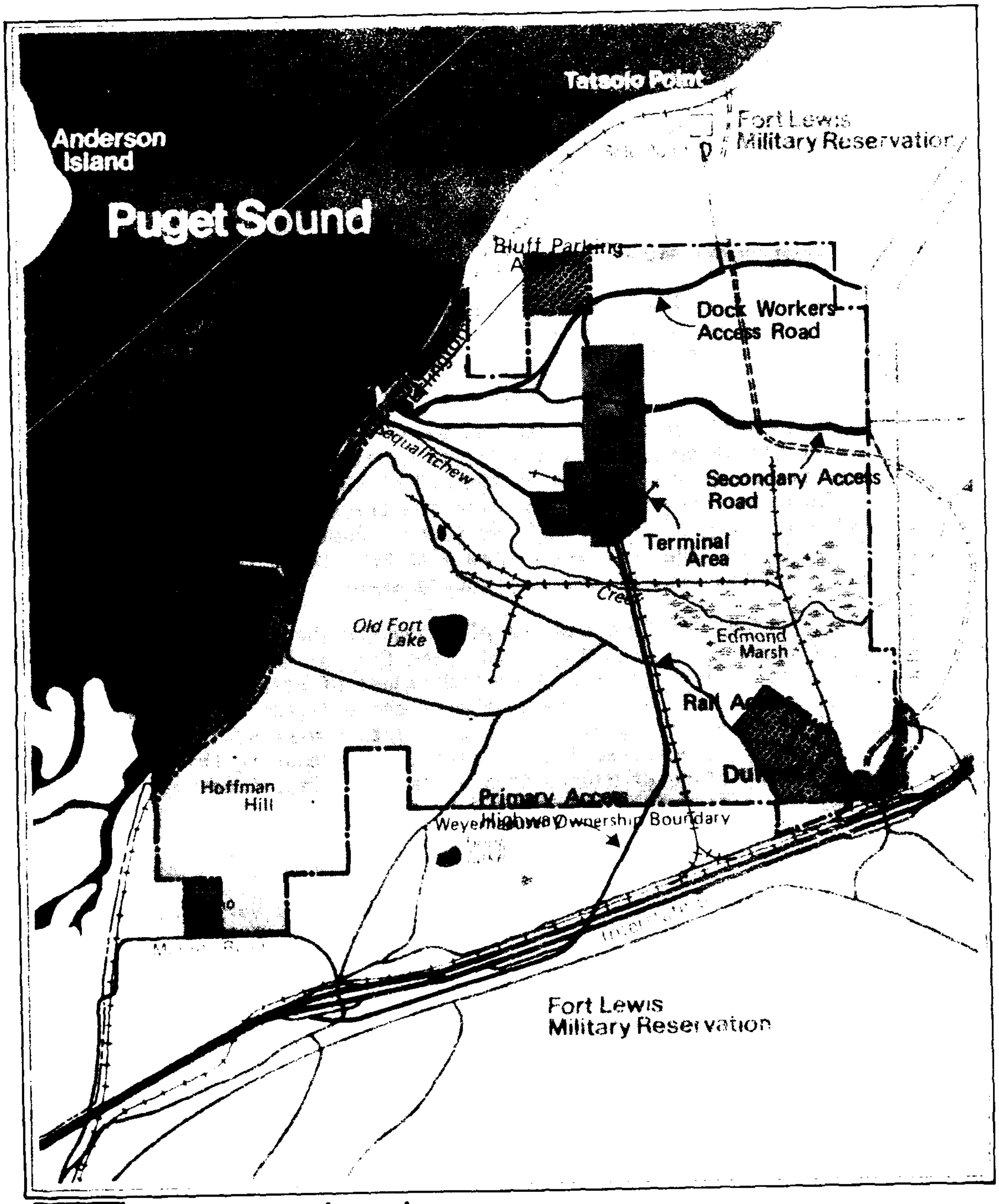
One of the general policies delineated by the act is that the management of "Shorelines of Statewide Significance" give preference to uses in the following order:

1. Recognize and protect statewide interest over local interest.

2. Preserve the natural character of the shoreline.

3. Result in long-term over short-term benefit.

4. Protect the resources and ecology of the shoreline.



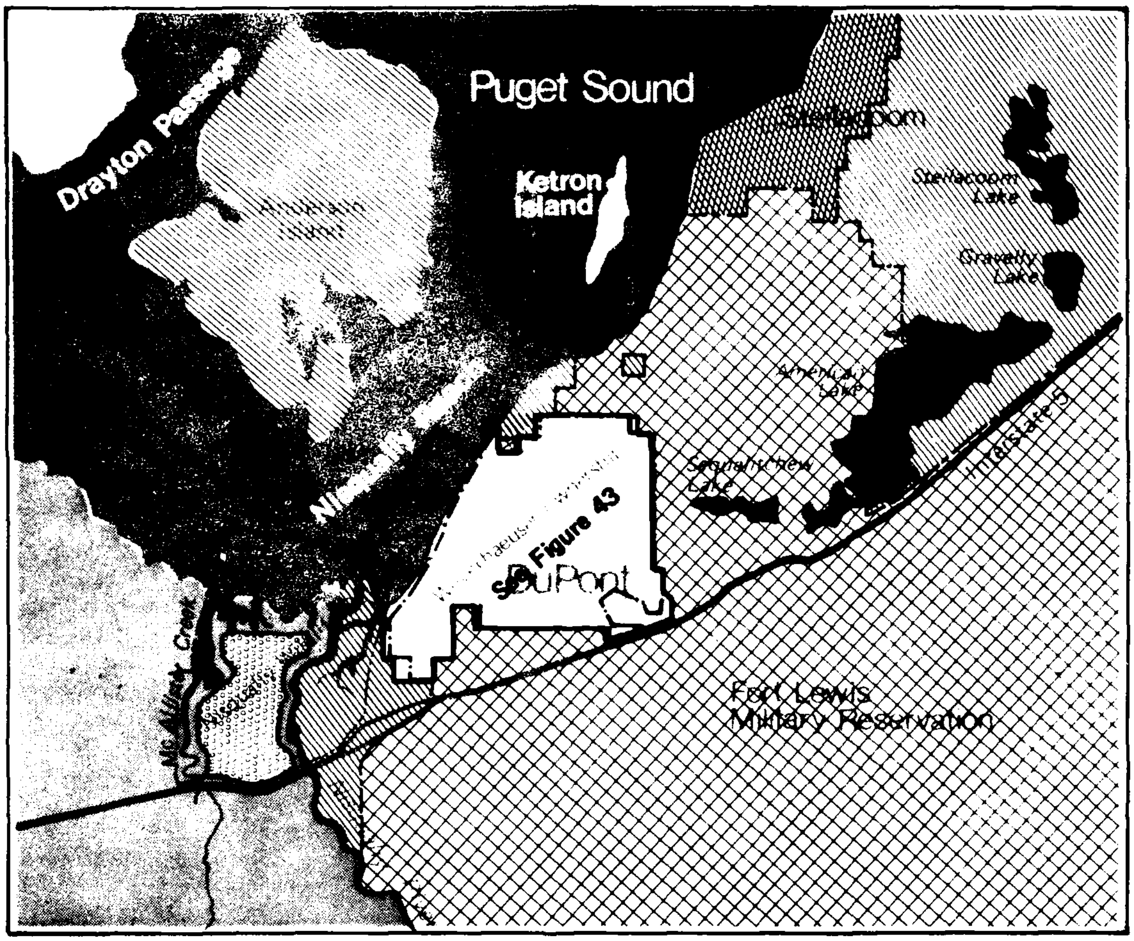
Scale in Miles
.25 .5 1

Legend

City of DuPont Jurisdiction

Other Ownership Within City of DuPont Jurisdiction

FIGURE 43
DuPONT JURISDICTIONAL BOUNDARIES



Scale in Miles
1 5

Legend

- City of Steilacoom
- Department of the Interior (USFWS)
- United States Army
- Thurston County
- Pierce County
- City of DuPont

FIGURE 44
REGIONAL JURISDICTIONAL BOUNDARIES

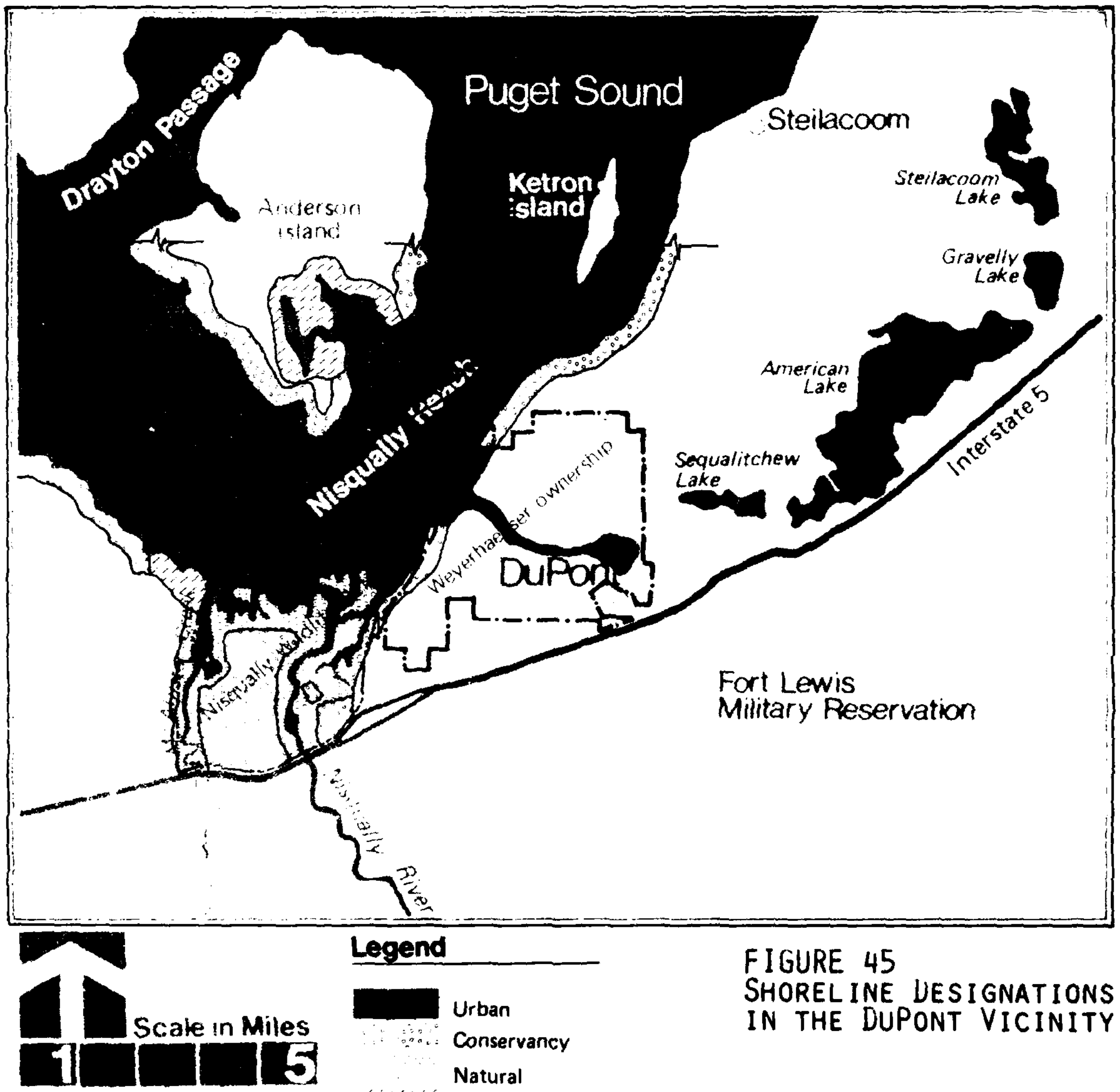


FIGURE 45
SHORELINE DESIGNATIONS
IN THE DUPONT VICINITY

Source City of DuPont, 1975
Thurston County, 1975
Pierce County, 1974

5. Increase public access to publicly owned areas of the shorelines.

6. Increase recreational opportunities for the public on the shoreline.

7. Protect life and property from hazards of flood.

8. Provide for any other element as defined in RCW 90.58.100 deemed appropriate or necessary (RCW 90.58.100 defines elements to be included in local master plans).

The Shoreline Management Act also states that "alterations of the natural condition of the shorelines of the state, in those limited instances when authorized, shall be given priority for single family residences, ports, shoreline recreational uses including but not limited to parks, marinas, piers, and other improvements facilitating public access to shorelines of the state, industrial and commercial developments which are particularly dependent on their location on or use of the shorelines of the state and other development that will provide an opportunity for substantial numbers of the people to enjoy the shorelines of the state."

Most developments along the state's shorelines require that a substantial development permit be issued by a local government before the development can occur. A permit can be issued only if the development is consistent with a local jurisdiction's shoreline master program. Each county and city jurisdiction with a shoreline as described in the Shoreline Management Act has a shoreline master program which has been approved by the Washington State Department of Ecology.

The Department of Ecology's Final Guidelines for the Shoreline Management Act of 1971 (Washington State, 1971) establish a framework of four categories of shorelines, based on the degree of human intrusion into the shoreline and the degree of uniqueness of the shoreline. The categories apply to the shorelines which are defined as all areas below the ordinary high water mark and upland for 200 feet (measured on a horizontal plane) from the ordinary high water line or the edge of any swamp, bog, or floodplain, whichever is farthest. These four categories are termed the Natural, Conservancy, Rural and Urban Environments. As required by the Guidelines, the City of DuPont has classified their shorelines. In 1975, the Washington State Department of Ecology (WDE) approved DuPont's Shoreline Master Program. The letter approving the program stated that "The Urban environment theoretically would allow intense industrial and commercial development. For this reason, we remain concerned about the potential impact on the Nisqually Estuary. Our primary interest is the preservation of Nisqually delta as a natural area consistent with its recognition as a National Wildlife Refuge and a National Landmark. Any activity which might have a negative effect on the delta would be contrary to the intent of the Act, which specifically identified the Nisqually delta as a shoreline of statewide significance to be preserved in its natural condition" (Biggs, 1975). The letter is included in Appendix J. In 1980, DuPont requested a change in their Shoreline Master Program to exchange the southern 1,600 foot portion of the urban designation along Puget Sound to conservancy and then designate their newly annexed northern 1,600 foot shoreline as urban which had been designated conservancy by Pierce County. The approval is pending. The City of DuPont's shorelines have been placed in

two categories: Conservancy and Urban (Figure 45). These categories are described by the City of DuPont Shoreline Master Program in the next two subsections.

3.1.1.1 DuPont Conservancy Environment. "The Conservancy Environment is designed to protect, conserve and manage existing natural resources and valuable historic and cultural areas in order to ensure a continuous flow of recreational benefits to the public and to achieve sustained resource utilization. This environment should also include areas of steep slopes which present potential erosion and slide hazards, areas prone to flooding, and areas which cannot adequately deal with sewage disposal."

DuPont designated the shoreline on both sides of the Urban designation for Conservancy Use (Figure 45).

3.1.1.2 Urban Environment. "The objective of the urban environment is to ensure optimum utilization of shorelines within urbanized areas by providing for intensive public use and managing development so that it enhances and maintains shorelines for a multiplicity of urban uses."

"The urban environment is an area of high-intensity land use including residential, commercial, and industrial development. The environment does not necessarily include all shorelines within an incorporated city, but is particularly suitable to those areas presently subjected to extremely intensive use pressure, as well as areas planned to accommodate urban expansion. Shorelines planned for future urban expansion should present few biophysical limitations for urban activities and not have a high priority for designation as an alternative environment."

"Because shorelines suitable for urban uses are a limited resource, emphasis should be given to development within already developed areas and particularly to water-dependent industrial and commercial uses requiring frontage on navigable waters."

"In the master program, priority is also to be given to planning for public visual and physical access to water in the urban environment. Identifying needs and planning for the acquisition of urban land for permanent public access to the water in the urban environment should be accomplished in the master program. To enhance waterfront and ensure maximum public use, industrial and commercial facilities should be designed to permit pedestrian waterfront activities. Where practicable, various access points are to be linked to non-motorized transportation routes, such as bicycle and hiking paths."

The shoreline adjoining the Weyerhaeuser DuPont properties is not owned by Weyerhaeuser Company. It is owned by the Burlington Northern Railroad Company (Figure 5). Weyerhaeuser has an easement to cross the lands to gain access to Puget Sound. The proposed dock location would be partly on tidelands owned by Weyerhaeuser and partly on bedlands owned by Washington State.

The portion of DuPont shoreline within the south half of Section 22 (T19N, R1E) includes the existing dock and is classified for urban land use (Figure 45).

Sequalitchew Creek and the Edmond marsh are listed in the current inventory of waters considered to be covered by the Act and is designated urban in the DuPont Shoreline Master Program.

3.1.1.3 Adjacent and Surrounding Shorelines. Regarding adjacent and surrounding shoreline designations, both Thurston and Pierce Counties have designated the Nisqually Delta Refuge as Natural and Conservancy. The Natural designation is intended to preserve those dynamic natural systems relatively free of human influence and to discourage or prohibit those activities that might alter the natural characteristics that make the shoreline areas unique and valuable.

Across from the site, Pierce County has designated the shorelines of Anderson Island as Conservancy and Rural. According to the Pierce County Shoreline Master Program, "the Rural Environment is intended to protect agricultural land from urban expansion, restrict intensive development along undeveloped shorelines, and encourage the preservation of open spaces and opportunities for recreational uses compatible with agricultural activities." Those shorelines north of the DuPont site under the jurisdictions of Pierce County and the U.S. Army have been placed in the Conservancy category.

The Washington Coastal Zone Management Program (under the Federal Coastal Zone Management Act) has designated the Nisqually Reach as an "area of particular concern." These are areas where pressures exist from competing uses; such as recreational and commercial. The Program relies largely on the Washington State Shoreline Management Act of 1971 to establish policies, guidelines, regulations, and procedures governing development of land within these areas. In most instances, a proposed project is in compliance with Coastal Zone Management Act when it complies with the Shoreline Master Program and meets federal and state water and air quality laws. The Washington State Department of Ecology (WDE) reviews and determines a proposed project's consistency with the Coastal Zone Management Act. The WDE can appeal any substantial development permit that a city or county government issues.

3.1.2 Comprehensive Land-Use Plans and Zoning

3.1.2.1 DuPont. Descriptions of present land use and proposed zoning for the area presently within the City of DuPont are included in the Comprehensive Planning Study for Annexation (Johnson/Pazooki/McMenamin, 1971). The study recommended that the proposed area be annexed and zoned for industrial use (Figure 46). The City of DuPont followed the study recommendation and in 1971-1972 annexed the DuPont property and zoned it for industrial use.

3.1.2.2 Pierce County. As shown in Figure 47, Pierce County's comprehensive plan designated the Fort Lewis properties surrounding the site for government use and zoned for general use. The southwest property adjoining the site is privately owned, with part of it in DuPont, zoned

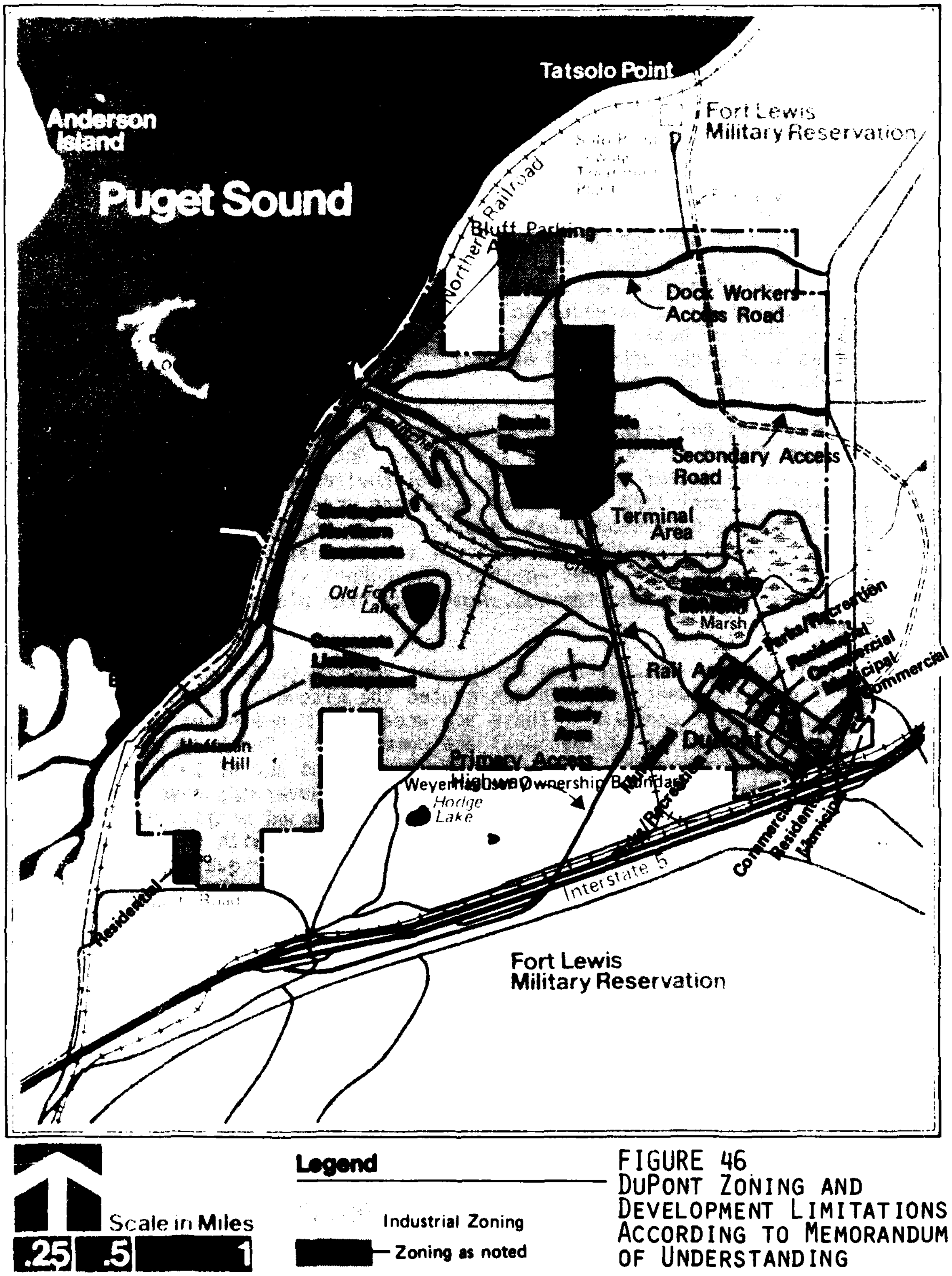
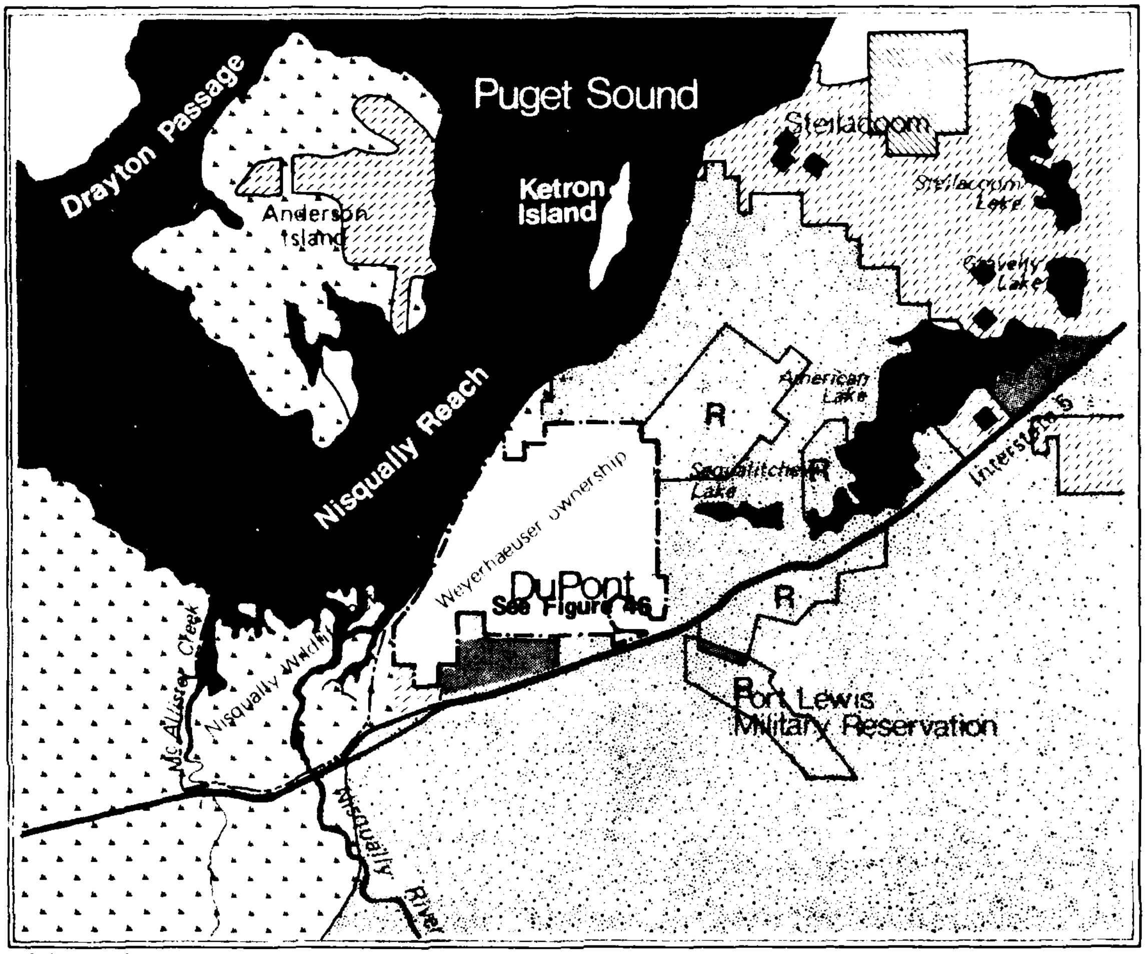


FIGURE 46
DUPONT ZONING AND DEVELOPMENT LIMITATIONS ACCORDING TO MEMORANDUM OF UNDERSTANDING



Source. Pereria Associates, 1977

FIGURE 47
REGIONAL USE OF LAND

for residential use, and the rest of it in Pierce County designated for rural use and zoned for general use. General use allows practically all uses.

3.1.2.3 Thurston County. Regarding the Thurston County portion of the Nisqually Delta and lands adjacent to it, the Thurston County Comprehensive Plan states, "There will be no deep water port or industrial piers on Nisqually Reach and no industrial transportation corridor to the waterfront" (Thurston County Planning Council, 1977). The plan designates only 600 acres on Hawks Prairie for industrial development, and specifies only highway oriented industries. No rail access is permitted. The Nisqually Delta itself is identified as a public reserve and environmentally sensitive. Lands immediately adjacent to it are proposed for Rural (one residence per acre).

3.1.2.4 Nisqually National Wildlife Refuge. The Nisqually National Wildlife Refuge Conceptual Plan (1978) states "The purpose of the Management Plan is to establish broad categories of control that define and guide a permissible intensity of development and use." That portion of the refuge under Fish and Wildlife Service jurisdiction (northeast corner nearest the DuPont site) is designated as a Research Natural Area and restricted for public use (Figure 48). The plan defines Research Natural Area as "an area where natural processes are allowed to predominate and which is preserved for the primary purpose of research and education. Once a Research Natural Area is established, succession is allowed to advance toward climax without interference. The area is protected against management activities which would directly or indirectly modify natural ecological processes or alter the type or feature being preserved. Public use of the area is discouraged, signs and publicity are avoided, and in general, an effort is made to attract as little public attention to the area as possible."

3.1.2.5 Fort Lewis Military Reservation. Much of Fort Lewis is wooded or open prairie and generally undeveloped. A comprehensive land use plan has been developed for this area. Continued use of the site for intensive military purposes and timber harvesting is planned.

3.1.3 Regional Land Use Policies

The Pierce Subregional Council designated the City of DuPont as a Suburban Center and a Growth Area (Pierce Subregional Council, 1979). A suburban center, according to the plan, is a primary area for growth outside urbanized areas, providing that public service extensions are economical and phased in a timely manner. A growth area is a region where urban services will be encouraged and/or provided.

3.1.4 Present Land Use (Figure 47)

3.1.4.1 DuPont. Until 1978, the E. I. duPont de Nemours Company used the site to manufacture and ship explosives. Remnants of the operations include a dock, unused small buildings, and a road/rail network scattered throughout approximately one-third of the 3,200 acres.

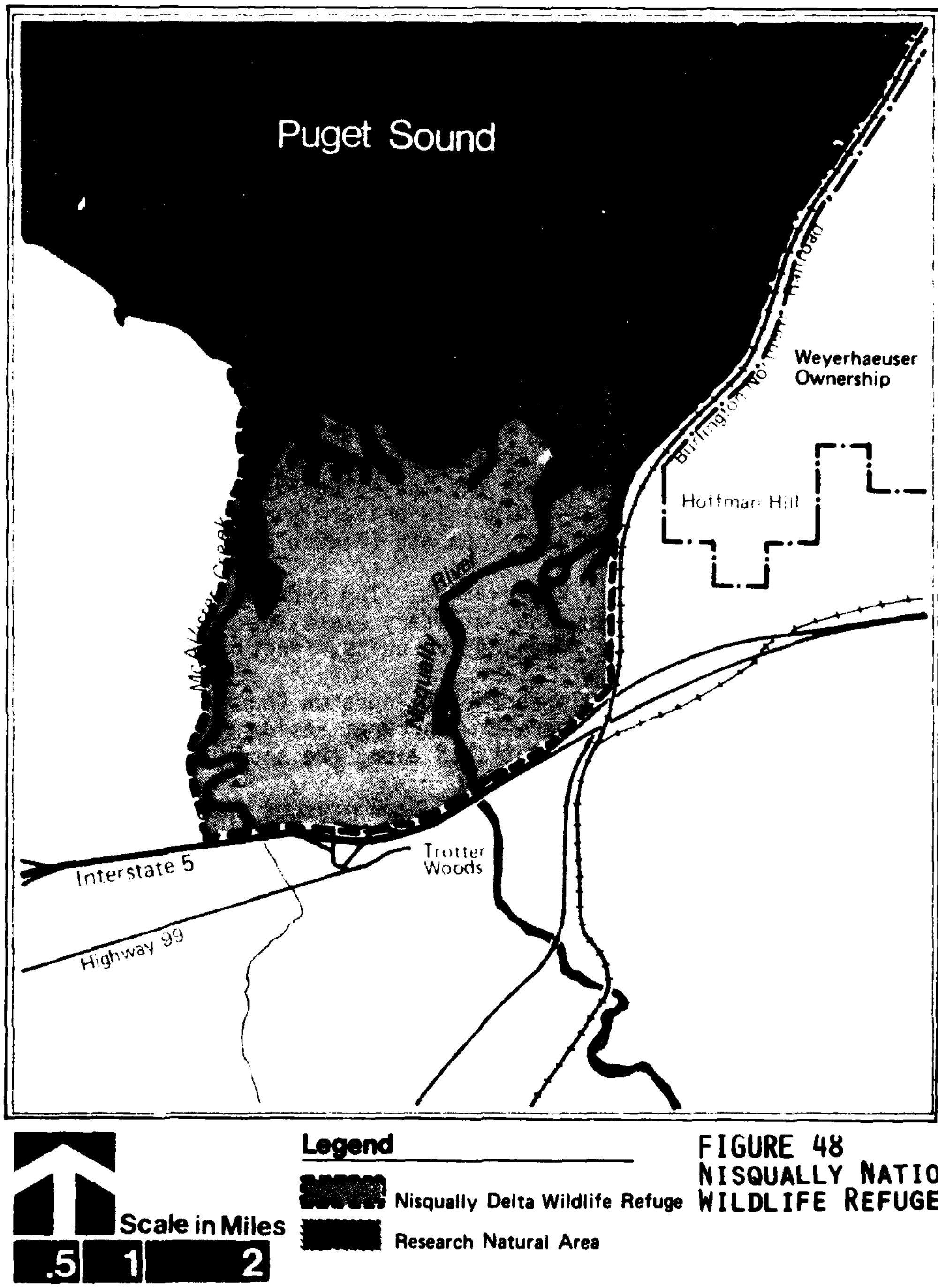


FIGURE 48
NISQUALLY NATIONAL WILDLIFE REFUGE

Source: US Department of Interior
Fish and Wildlife Service, 1978

The high risk nature of the operations required that the facilities be dispersed and connected by a network of roads, railways, and pipelines. Explosives were exported from the site by train, truck, and ships, which were loaded from the existing dock. The explosives were moved down the steep bluff to the dock by narrow guage rail. Raw materials arriving by ship were brought to the top of the bluff by a telferage system (open buckets on a cable system). Off-loaded oil for power boilers was pumped thru a pipeline from the dock to two storage tanks in the Creek Canyon and then later pumped to the upland area thru the pipeline as needed.

Much of the site remains undeveloped and provides a wildlife habitat and buffer for public protection and the neighboring wildlife refuge. The upland portion of the DuPont site is separated from the shoreline by a bluff and the mainline Burlington Northern railroad tracks.

3.1.4.2 Pierce County. Most of the area immediately around the DuPont site is occupied by the Fort Lewis Military Reservation; however, a small parcel of land between the City of DuPont and the Nisqually Delta (some of which is covered by the Shoreline Master Plan) is privately owned and occupied by farms and several residential developments (Figure 47).

3.1.4.3 Fort Lewis Military Reservation. The Fort Lewis Military Reservation is used for military housing, military exercises, training, and support for National Guard and U.S. Army Reserve units. Portions of it are logged.

3.1.4.4 Thurston County. In northeast Thurston County, agricultural and forest land use is interspersed with rural residential development. Residential development is concentrated along the shoreline and major roads.

The Washington State Department of Game manages approximately 625 acres of land which is the western portion of the Nisqually Delta. Its main features are a public fishing and boat launch area and a field laboratory, which is presently being leased to Evergreen State College for research.

3.1.4.5 Nisqually National Wildlife Refuge. The wildlife refuge (Figure 48), established in 1974, is operated by the U.S. Fish and Wildlife Service and is recognized as a valuable habitat for fish and wildlife. The Nisqually Delta provides migratory waterfowl with important wintering, resting, and feeding areas within the Pacific Flyway. The Delta has been designated as a National Natural Landmark. Further, the Delta has been placed in a Threatened Category II status (PL 94-485) by the Heritage Conservation and Recreation Service of the Department of Interior due to potential nearby industrial development.

3.2 CONSISTENCY OF THE PROJECT WITH EXISTING PLANS AND POLICIES

3.2.1 City of DuPont Policies and Zoning

The export facility proposal is consistent with the City of DuPont's zoning code. The site is zoned industrial, which conforms to the historical use of the property by the E. I. duPont de Nemours Company for production and shipment of explosives.

3.2.2 Shoreline Plans

The proposed dock location is within the urban designation portion of the DuPont shoreline; therefore, construction of the dock at that location would conform with the local shoreline master program. Weyerhaeuser's preferred alternative dock location (further north) would require approval from WDE for a change in the DuPont Shoreline Master Program from shorelines now designated conservancy to an urban classification.

On February 19, 1981, the City of DuPont issued a shoreline substantial development permit for the proposed project to proceed. DuPont found the project to be consistent with their Master Program. Eight pages of permit conditions are included within the permit which Weyerhaeuser must uphold if the permit is to remain valid (Appendix K). Several of the conditions reiterate the project description, assumptions, and mitigating measures that the impact analysis of the EIS is based upon. Additional conditions require that (1) noise from pile driving be limited to certain hours; (2) public access to the shoreline be provided; (3) Weyerhaeuser shall seek an agreement with the Nisqually Indian Tribe to minimize any adverse effects on treaty rights; (4) storm and sanitary drainfields shall be at least 500 feet from Sequalitchew Creek; (5) construction workers shall receive training to detect archeological artifacts prior to beginning work; (6) construction and operation access roads are identified; (7) Weyerhaeuser shall maintain a one year ground and surface water monitoring program after operations begin which would be overseen by the WDE; (8) Weyerhaeuser submit an oil contingency plan to DuPont for their review and approval prior to the first ship docking; (9) and construction scheduling would be reviewed by DuPont prior to finalization.

The State of Washington Department of Ecology (WDE) will review the proposed project's consistency with the Shoreline Master Program and compliance with the Federal Coastal Zone Management (CZM) Act. The WDE and other agencies give special attention to proposed projects on shorelines of statewide significance and "areas of particular concern."

On June 19, 1981 an agreement was reached between WDE, the City of Dupont and Weyerhauser Company. The WDE found that the substantial development "permit, as supplemented by the terms of this Agreement, for a forest products transshipment facility project, consisting primarily of a dock, access roads, marshalling yard and road and rail access from Intersate Highway No. 5, is consistent with the pertinent policies of the Shoreline Management Act and the applicable master program" (Appendix K).

Conditions of the agreement require that (1) the City of Dupont will complete a new comprehensive land use plan on or before January 31, 1984; (2) the city will form an Advisory Committee to assist in authoring the new comprehensive plan which will at least include representatives of the Washington Departments of Ecology, Fisheries, Natural Resources, Game, Commerce and Economic Development and the Mayor of Dupont as the chairman of the committee; (3) Weyerhauser will not construct any other major facilities other than those noted above unitl January 31, 1984 or until the adoption of the new comprehensive plan, whichever comes first; (4) an EIS will be prepared for the new comprehensive plan prior to adoption; (5) Weyerhauser may terminate this agreement if they surrender the rights of the shoreline permit;

(6) WDE will provide up to $150,000 for development of the comprehensive plan and Weyerhauser will reimburse 50 percent of the comprehensive plan cost to WDE; (7) Weyerhauser will not ship any potentially toxic or hazardous materials from the proposed facility without WDE approval; (8) Weyerhauser will give City of Dupont and WDE 30 days notice prior to shipping non-forest product cargoes from the proposed facility and such shipments may be conditioned by the two agencies; and (9) Weyerhauser will periodically monitor surface water quality at its boundaries adjacent to the refuge for three years (see Appendix K for more detail on the terms of the agreement).

The Washington State Department of Natural Resources has not established harbor, pierhead, or bulkhead lines in the area. However, the establishment of these lines would not preclude the project from receiving federal and state permits nor would the establishment of these lines be required before the dock could be permitted.

3.2.3 Surrounding Jurisdiction's Land Use Plans and Zoning

Fort Lewis, which surrounds most of the DuPont site, uses most of its lands more intensively than would the export facility. The export facility would not interfere with the activities of Fort Lewis. Coordination with the Department of the Army has determined that the export facility would not be in conflict with Fort Lewis' plans.

Any possible conflicts with comprehensive land use plans for Thurston County, which is about three miles from the project site, would be indirect (resulting from population growth pressures in excess of that desired, particularly in the northeast Thurston subarea). Conflicts could be avoided by land use controls.

U.S. Army use of portions of this site for a rifle range, driving practice area, and landfill site is expected to continue. Regular use of Burlington Northern railroad lines along the shoreline would continue.

3.2.4 Regional Land Use Policies

Development of the site would be consistent with the Pierce Subregional Council's designation of it as a suburban center and a recognized growth area.

3.3 MEMORANDUM OF UNDERSTANDING

In recognition of the broad interest in the nearby Nisqually Delta and the management responsibilities of public resource agencies, Weyerhaeuser Company entered into negotiations to develop a Memorandum of Understanding (MOU) with the U.S. Department of the Interior, Fish and Wildlife Service (FWS). The MOU would restrict development in certain areas of the DuPont site. A draft of the MOU has been included in this EIS as Appendix K. Figure 46 indicates the approximate locations covered by this MOU. The intent of this MOU is primarily to minimize the effects of development on wildlife habitat of the site, the neighboring Nisqually Delta, and the Wildlife Refuge. This agreement, which is expected to be signed by the FWS, pending

their review of the FEIS, is contingent upon the proposed export facility being built. Weyerhaeuser has committed to the terms of this MOU in the agreement signed between Weyerhaeuser, WDE, and the City of DuPont described in Section 3.2.2. The main features of the MOU follow:

a. The bluff south of Sequalitchew Creek and adjacent to Hoffman Hill would be maintained as open space for recreation and/or research (approximately 23 acres). Clear-cutting would be prohibited. Weyerhaeuser would grant a scenic easement to the FWS.

b. An approximately 47 acre scenic and wildlife management easement in Sequalitchew Creek Canyon would be granted to Washington State and managed by the Departments of Game and Fisheries. The conditions of use are essentially the same as those for the bluff areas.

c. The uses of the area adjacent to the bluff scenic area on Hoffman Hill (approximately 21 acres) would be limited to forestry, agriculture, grazing, open space "common area" for any developments on adjoining land, recreational use at Weyerhaeuser's discretion and low density residential uses (one unit per acre).

d. Basic manufacturing or similar heavy industrial uses would be prohibited in the area surrounding Old Fort Lake (approximately 27 acres).

e. The 49 acre area of Oak Savannah vegetation type would be designated as a wildlife study area. These lands would be held for possible future development, but in the interim, they would provide opportunities for wildlife research.

f. Weyerhaeuser and FWS would jointly recommend to the City of DuPont that the 117 acre Edmond Marsh area be: (1) redesignated from "urban" to "conservancy" in the city's Shoreline Management Master Program, (2) designated as a "conservation area" in any city Comprehensive Plan, and (3) zoned accordingly. If the city does not redesignate the area as conservancy, Weyerhaeuser would execute an agreement with FWS limiting activities near Edmond Marsh to those consistent with a "conservancy" designation.

g. If the export dock were constructed in the alternative location, Weyerhaeuser and FWS would jointly recommend to the City of DuPont that all Weyerhaeuser-owned tide-lands south of Sequalitchew Creek be redesignated from "urban" to conservancy" in any city plan. If the city is not in agreement, Weyerhaeuser would execute an agreement to limit its activities in these tidelands to those consistent with a "conservancy" designation.

h. Weyerhaeuser would use its best efforts to influence Burlington Northern, Inc. to grant a scenic easement to the U.S. on its lands in those areas along the bluff that Weyerhaeuser has an easement (south of Sequalitchew Creek and adjacent to the Hoffman woods).

4.0 Environment Impact of the Proposed Action

This chapter includes, for each component of the environment, an assessment of the probable impacts of the proposed export facility. Aspects of the environment that are likely to be significantly impacted are emphasized. Mitigating measures that would be used to eliminate or minimize adverse impacts are identified.

4.1 EARTH

Earth-related impacts associated with construction and operation of the proposed facilities would include an increased potential for erosion and sedimentation, consumption of mineral resources, and minor topographic changes.

Increased erosion hazard would occur in Sequalitchew Creek canyon during construction of the road from the terminal area to the dock. This increased erosion would cause sedimentation in Sequalitchew Creek.

Consumption of mineral fuels and continued erosion on the path used by the longshoremen to go down the bluff just north of Sequalitchew Creek would be the only earth-related impacts during operation of the facility.

4.1.1 Topography

The topography of the site would be altered by the proposed project. Most of the changes would involve structures rather than changes in the natural relief. Various buildings, storage areas, roads and a dock would be constructed and the existing wharf removed. Construction of the buildings, storage areas, and transport facilities would require some clearing and grading (169 acres of woodlands) and excavation (652,000 cubic yards).

Three acres of mixed forest in the Sequalitchew Creek canyon would be cleared for construction of a reinforced-earth road from the terminal area to the dock. This 57-foot wide road would be constructed along the northern slope of the canyon on an existing bench. The bench would be widened by construction of a variable-height retaining wall as much as 30 feet high. A cut 40 feet long and a maximum of 10 feet deep would be necessary where the road enters the canyon.

4.1.2 Geology

The geological formations underlying the site would be unaffected by the project.

4.1.3 Soils

All portions of the site where construction would take place are covered by Spanaway soils except for the Everett soils along Sequalitchew Creek. Spanaway and Everett soils are generally suitable as foundations for roads and low buildings except where slopes are too steep. Spanaway soils drain so rapidly that effluent from the septic-tank drainfield and the disposal of stormwater runoff may cause ground water contamination. This possibility is discussed in more detail in Section 4.5.2.

4.1.4 Mineral Resources

The proposed facility would make gravel deposits, the only significant mineral resource on the site, less accessible.

In addition, consumption of mineral resources would occur during construction and operation of the proposed facility. During construction, sand and gravel would be consumed for fill and paving materials. Fuel would be used for operation of construction equipment. Consumption of fuel for space heating and operating equipment would be the only operational impact.

4.1.5 Geologic Hazards

The proposed facility would increase the hazards of erosion and slope failure in Sequalitchew Creek Canyon. The seismicity of the site would be unaffected. The proposed dock would be more resistant to earthquake than the existing wharf.

During construction of the dock access road, portions of the slope immediately above Sequalitchew Creek would be cleared and some soil removed to widen the bench where a narrow-gauge railway is presently located. The road would then be constructed by adding fill. These activities would increase the potential for erosion. The amount of erosion would depend on the amount of rainfall that occurs during or immediately after construction and the erosion control measures used. Construction would occur between June and September, thus avoiding the period of greatest rainfall and highest erosion potential.

A variety of effective erosion control measures have been developed (URS, 1977a). Methods appropriate to each location where construction would occur would be used. In addition, the dock access road would be constructed progressively, so that the amount of soil exposed by excavation at any one time would be minimized (probably less than 500 feet). Measures such as temporary diversions with sediment basins or filter screens would minimize sedimentation in Sequalitchew Creek if a major storm occurred during construction. Monitoring the creek for turbidity during construction would help indicate when additional erosion-control measures should be implemented.

The lower portion of the dock access road would be a causeway supported on concrete piles Construction of this segment would temporarily disturb beach sediments and increase turbidity. Similarly, construction of the dock would increase near-shore turbidity during the construction period. The sediments in the area of the proposed dock, south of the existing DuPont dock, are less compact than those at the alternative dock location, north of the existing dock and the mouth of Sequalitchew Creek. Longer piles would be required in the proposed (southern) dock location because of the presence there of a relatively greater thickness of less compact sediments (Hart-Crowser, 1976). These more loosely packed, homogenous sediments would result in a greater seismic risk to the dock constructed in that location. In an earthquake, a greater potential would exist for sediments in the proposed dock location to lose their bearing strength through liquefaction (Hart-Crowser, 1976). Because of these unfavorable sediment characteristics, the duration of construction in the proposed dock location would be greater. Thus, construction-related impacts such as increased turbidity from pile-driving would be of longer duration.

Clearing and grading operations for the staging area, primary access road, and rail access would slightly increase the potential for erosion. However, because of relatively flat terrain on portions of the site affected by these facilities, short-term erosion during construction would be minimal. The most erosion-sensitive area for these construction activities would be the crossing of Sequalitchew Creek by the primary access road and the access railroad. Construction during periods of low flow (June-September), would reduce the potential for erosion substantially. Erosion along the proposed access roads would be minimized by planting a low ground cover along cleared rights-of-way and by erosion control measures, such as those discussed in Stormwater Management Procedures and Practices (URS, 1977a), to protect slopes until vegetation is established.

During operation of the facility, increased vessel movements in southern Puget Sound and activity on the bluff would slightly increase the potential for erosion. Ships calling at DuPont would generate wake waves less than one foot high. These waves would impact on a given section of shoreline for about thirty seconds. Comparable waves are generated by vessels such as pleasure craft, tugs, and barges that currently operate in southern Puget Sound. In contrast, storm waves in the area range up to four feet in height with duration of two to 30 hours. Hence, the vessel generated waves are expected to cause insignificant increases in the existing rate of erosion of the bluffs bordering southern Puget Sound. Erosion along the path from the longshore parking lot to the dock would continue if the path is not surfaced. The path would be improved and drainage measures incorporated to assure the safety of workers who use the path. The path would be improved and maintained to minimize erosion to the extent that the City of DuPont determines such action to be necessary.

The hazard of slope failure would be minimized by avoiding steep cuts, especially in the ravine and on the bluff. The road would pass through the area of Kitsap formation identified on Figure 16; however, appropriate design based on additional soil borings would avoid stability problems. Only a

ten-foot cut at the point where the road enters the canyon would be required. Steep cuts have been avoided in the design. The design would minimize potential for failure of the reinforced-earth road.

4.1.6 Accretion/Avulsion

Increased deposition at the mouth of Sequalitchew Creek, including the underwater delta, would occur due to increased erosion from construction of the dock access road. Because Sequalitchew Creek is confined by the walls of the canyon to a very narrow floodplain, avulsion would not occur.

4.1.7 Earth Mitigating Measures

Weyerhaeuser has committed to employ the following mitigation to minimize impacts on earth resources: (a) the path down the bluff would be improved and maintained to the extent that the City of DuPont determines is necessary to minimize erosion and improve access for firefighting personnel and equipment; (b) use of appropriate erosion control measures to reduce sediment movement during construction; (c) dock access road would be constructed in stages such that the amount of soil exposed at any one time is minimized, and temporary diversions with sediment basins or filter screens; (d) piles would be of adequate length to minimize the seismic risk; (e) construction of the primary access road and railroad crossing of Sequalitchew Creek during low flow periods (June-September) would reduce potential erosion; (f) the hazard of slope failure would be reduced by avoiding steep cuts; and (g) monitoring of Sequalitchew Creek turbidity during construction and implementation of any necessary additional erosion controls would reduce erosion and sedimentation. Monitoring of ground and surface water quality of the Creek during facility operation will be in accordance with a plan satisfactory to the Department of Ecology; required steps will be taken to prevent continuation of any violation of water quality standards.

4.2 CLIMATE

No impacts are expected.

4.3 AIR QUALITY

The impact of construction and operation of the proposed facility on regional and local air quality would be minor. During maximum construction activity, concentrations of suspended particulates would exceed the 24-hour standard on windy days when the existing background levels are high. No violations of any ambient air quality standards are expected during operation of the facility.

4.3.1 Regulatory Environment

The proposed facility would not have emissions large enough to require permits for PSD or nonattainment areas.

4.3.2 Regional Air Quality

Results of the modeling analysis are shown in Figure 49. Regional impacts due to construction would be minimal. The amount of fugitive dust (particulates) generated during construction has been estimated (Ward, 1978) to be about 2400 lb/acre/month. Short-term (one hour) and long-term (one year) modeling analyses were performed using this emission factor, the PTDIS and VALLEY models, equipment assumptions and various other assumptions detailed by Ward (1978).

The operational impacts of the facility on regional air quality would be negligible according to results of various modeling analyses. Expected emissions due to operation of the proposed facility are shown in Table C-5, Appendix C. These emissions would constitute only a small fraction (less than two percent for any pollutant) of existing Pierce County emissions. The only regional air quality impacts would result from the exhaust emissions of trucks during transportation. This impact would be negligible (Ward, 1978).

4.3.3 DuPont Site Air Quality

The modeling analyses discussed in the previous section indicate that on windy days during periods of maximum construction activity (when both project-related emissions and background levels are at a maximum), the 24-hour local standard for suspended particulates would be exceeded. This impact would be short term and limited to the site.

Operational impacts, predicted by the modeling discussed above, would be negligible. Worst-case modeling of the impacts at the primary access route indicate negligible impacts (Ward, 1978). Operations of switching locomotives would also have minimal impacts. Emissions from the ships at the dock under worst-case conditions--high atmospheric stability (Class E) and low wind speed (4.5 miles per hour)--would cause maximum sulfur dioxide concentrations of 77 ug/m^3, well below state and local standards. Similarly, gaseous emissions and small amounts of fugitive dust that would be generated by activities in the terminal area would not cause violations of any air quality standards or PSD requirements.

Emissions of suspended particulates during construction would be minimized by standard watering techniques and by operation of construction vehicles at lower speeds on windy days. Emissions from the unpaved road to the dock parking area could be reduced by paving the road; however, it is unlikely that the emissions would be sufficient to warrant paving.

4.3.4 Air Mitigating Measures

Weyerhaeuser has committed to employ the following mitigation to minimize impacts on air quality: (a) during construction and dry periods, disturbed areas would be watered to control dust; and (b) construction vehicles would operate at reduced speeds on dry windy days.

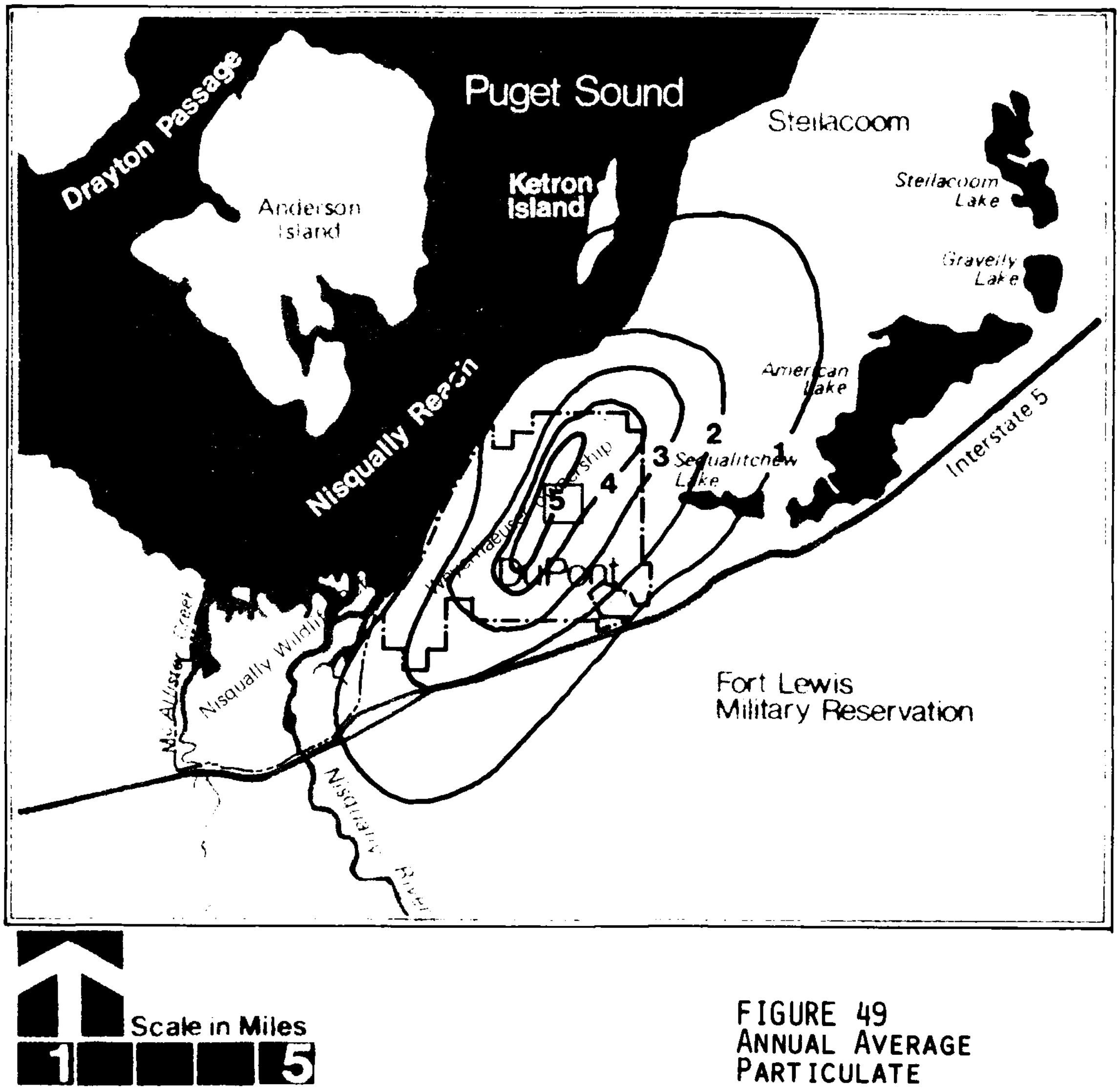


FIGURE 49
ANNUAL AVERAGE
PARTICULATE
$\mu g/m^3$

4.4 ODOR

The proposed project does not include activities that would produce significant off-site odor problems. Some odors, such as those associated with asphalt paving, may be associated with construction activities. It is unlikely that these would be detectable off the DuPont site. Similarly, operation of diesel trucks and sorting equipment would produce odorous emissions on the site itself.

4.5 WATER

Impacts of the proposed export facility on quantities or movement of freshwater and marine water resources near the site would probably be relatively minor, although significant impacts on water quality are possible.

Movement of stormwater runoff and patterns of groundwater recharge would be altered slightly on portions of the site where facilities would be located. Because withdrawal rates would be lower than those of the DuPont Company, the new facility would have less impact on groundwater hydrology. Some contaminants from the terminal could reach groundwater, but little impact on groundwater quality would be expected.

Streamwater flow in Sequalitchew Creek might be reduced, and water quality degradation of the creek would be possible, although no violations of state standards would be expected. Potential degradation of adjacent marine water would be of concern because pollutants might be carried toward the Nisqually Delta; however, only a major oil spill would be likely to cause significant adverse impacts on the Delta. The risk of flooding of waterfront homes by waves would be minimal (OIW, 1977).

4.5.1 Freshwater Hydrology

The proposed project includes several features that would modify surface and groundwater hydrology of the site to some extent. Impervious surfaces would be created on several portions of the site. Rain falling on these surfaces would no longer percolate directly into the ground. Runoff would be handled differently for each of three categories of impervious surfaces. Because runoff would be recycled, allowed to infiltrate, or be discharged directly into Puget Sound, on-site erosion would not be increased by these changes in hydrology. These resources would also minimize the likelihood of changes in the flow of Sequalitchew Creek. Runoff from the 124-acre storage area would be directed to a holding pond (for reuse in log spraying or fire protection) or to a drainage field. Log storage/debarker area runoff would first be sent through a skimming and solids-screening system.

Use of a holding pond/drainage field would not result in a significant change in the groundwater-recharge pattern. Recharge would be reduced by the extent to which water is consumed rather than allowed to infiltrate, possibly reducing groundwater seepage into Sequalitchew Creek. The withdrawal of three percent of the groundwater that is estimated to be available (Section

2.5.1) might decrease seepage into the creek, but most of this would be returned to the upper aquifer via the septic drainfield. It is, therefore, reasonable to conclude that there would be little change in the seasonal low flow now experienced in Sequalitchew Creek during the summer months.

Impacts on hydrology from new roads would be minor. Runoff from the dock access road, which covers three acres, would be directed to holding tanks on the dock. After settling, separation, and needed treatment, it would be released into Puget Sound. This diversion would slightly reduce peak storm inflow to the creek during the wet season, but the effect on low flow would be negligible.

The concrete retaining wall would have no significant effect on Sequalitchew Creek streamflow. A gravel blanket under the earth fill of the road would carry drainage water towards the creek. The gravel blanket would end behind the wall and above the footing. Three-inch diameter weepholes would then be placed every 10 to 15 feet to relieve the hydrostatic pressure behind the reinforced-concrete retaining wall and allow drainage to the creek. Culverts would be placed under the road to drain existing springs and natural drainage channels. Runoff from other roads would be directed to ditches to infiltrate, causing minor changes in groundwater-recharge patterns.

Where the primary access road crosses the creek, the creek would be routed through a culvert. The reinforced-earth dock access road (see Figure 8) would slightly alter sub-surface water movement in the ravine. Water that previously flowed through the area would flow through the gravel blanket that would underlie the road. The amount reaching the creek would be unchanged.

Minimizing groundwater withdrawal by recycling some of the runoff would decrease the likelihood of changes in the flow of Sequalitchew Creek.

4.5.2 Freshwater Quality

4.5.2.1 Construction-related impacts. Construction of the proposed dock access road has greater potential for adverse impacts on Sequalitchew Creek's water quality than do other aspects of the project. Appropriate measures would be taken to reduce erosion and minimize increases in stream turbidity due to construction activities.

Impacts related to spills of construction materials (dirt, gravel, asphalt, cement) would be adverse; however, the incidence of such inadvertent spillage would be expected to be infrequent. Because the drainage system on the dock access road would be completed prior to paving, runoff would be directed away from Sequalitchew Creek for treatment at the dock. Potential contaminants in runoff from asphalt and concrete pavement include hydrocarbons from asphalt and lime and fine sediment from concrete. Such contaminants would be collected by the access road drainage system and would not enter Sequalitchew Creek.

Erosion-control measures discussed in section 4.1.5 would minimize turbidity in the stream during construction of the dock access road. Monitoring of turbidity in Sequalitchew Creek during construction would identify the need for additional erosion control measures. In addition, use of open-bottomed, arch-type culverts where the primary access route crosses the creek would maintain the natural stream bed while causing less disturbance to the banks than installation of a bridge. Revegetation of the streambank following construction would reduce siltation and consequent increased turbidity in Sequalitchew Creek. Construction of the culvert would be scheduled to avoid salmonid releases by the Washington State Department of Fisheries. The final crossing design would be subject to approval by the Washington State Departments of Fisheries and Game under the Hydraulics Project Approval Law (RCW 75.20.100).

Removal of vegetation in the canyon would not increase the amount of sunlight reaching the stream because of canyon topography; therefore, no significant increase in water temperature or stream algal growth would be expected.

Access roads to upland construction sites would be gravelled as necessary to minimize sediment runoff to Sequalitchew Creek or Puget Sound, and appropriate measures would be taken to ensure that roadside ditches providing stormwater runoff capacity do not become clogged with sediment. Avoiding compaction in these ditches would maintain their high infiltration capacity. Where runoff from roads must be diverted to other infiltration areas because ditch capacity is insufficient, the soil could be left undisturbed so that runoff would filter through it. This measure would protect groundwater quality; however, Weyerhaeuser engineers believe that the measure is unnecessary because of the rapid infiltration characteristics of the underlying ground.

4.5.2.2 Operational impacts. Following construction of the upland industrial site, water quality influences would be primarily from two sources: (1) sewage disposal, and (2) surface runoff. Table 17 provides a summary of the sources of potential contaminants, proposed methods of treatment, and destinations of these substances. The following section discusses the potential for contamination of groundwater and surface water due to the proposed export facility.

Pollutant loads carried by runoff are highly variable and difficult to predict. Factors that affect pollutant loading in runoff include rainfall intensity, type of land use, proximity to surface water, soil type, and number of antecedent dry days. Thus, estimates of the potential for water quality degradation due to operation of the proposed export facility are capable of indicating only general levels of impact.

Table 18 compares pollutant loadings in runoff from a Puget Sound Lowland forest with that from an industrialized area. While these values do not directly apply to the proposed export facility, they provide a range of values within which runoff from the facility would be expected to fall.

TABLE 17

SOURCES, CONTAMINANTS, AND DESTINATION OF WASTEWATERS FROM THE PROPOSED EXPORT FACILITY

Sources	Potential Contaminants	Treatment/Destination
Sewage from Upland Terminal and Dock	Biological Oxygen Demand (BOD), Nitrate and Ammonia, Phosphorus	Septic tank/drainfield system. Septic tank capacity would be 8,000 gallons. Drainfield located at least 500 feet from Sequalitchew Creek and bluff. Percolation of wastewater into ground.
Surface Runoff		
Log Storage Area	BOD, Nitrate and Ammonia, Phosphorus	Concrete-lined containment pond for primary treatment (settling and skimming). Treated water to be recycled for use in log sprinkling and fire protection. Excess water would be directed to unlined drainage pond for percolation into ground. Drainage pond would be located at least 500 feet from Sequalitchew Creek and bluff.
Finished Lumber Storage Area	BOD, Nitrate and Ammonia, Phosphorus, Wood Tropolones, Pentachlorophenol	Same treatment/destination as above.
Other Terminal Areas	BOD, Nitrate and Ammonia, Phosphorus	Unlined ditches for percolation into ground.
Dock and Dock Access Road	BOD, Nitrate and Ammonia, Phosphorus Oil/Grease, Trace Metals	Collection in 158,000 gallon tank under dock. Primary treatment to remove settleable solids, and oil/grease to level of 10 ppm. Treated water would be discharged to Nisqually Reach.

TABLE 18

COMPARISON OF POLLUTANT LOADINGS IN SURFACE RUNOFF FROM FOREST LAND AND AN INDUSTRIAL SITE[1]

	Typical Lowland Forest[2] (a)	Industrial Site[3] (b)	Typical Per-Capita Sewage Production[4] (c)
Biological Oxygen Demand (BOD)	3	7.1	15
Nitrate and Ammonia	9	0.6	3
Total Phosphorus	0.1	0.2	0.8

[1]lbs/acre/yr.
[2]Average of values for undisturbed forest and mixed forest/farm land.
[3]Values from industrial area along the Duwamish River (URS, 1977b).
[4]lbs/capita/yr based on a 5 day work week (Metcalf and Eddy, 1972).

TABLE 19

INCREMENTAL POLLUTANT LOADS FROM THE UPLAND TERMINAL AREA OF THE PROPOSED EXPORT FACILITY[1]

	Runoff	Sewage	Total
Biological Oxygen Demand (BOD)	820	2925	3745
Nitrate and Ammonia	0	585	585
Total Phosphorus	20	156	176

[1]Including Sewage and 200 Acres of Developed Upland Site (lbs/yr). Refer to text for derivation of figures.

Table 19 presents the incremental pollutant load expected to occur in surface runoff following conversion of the upland area from a relatively undisturbed area to an industrial site. The runoff estimate was obtained by subtracting the values in column (a) of Table 18 from those in column (b) and multiplying by the number of acres of upland terminal area (200 acres). Because the Weyerhaeuser site would handle logs, it is assumed here that nitrogen loading would remain unchanged after development compared to present conditions. Also, the Biological Oxygen Demand (BOD) calculated in Table 19 for runoff may be relatively low compared to most industrial sites because the products that would be stored and handled would be wood products.

Pollutant loadings in sewage are more reliably estimated than those in runoff. Typical pollutant loadings for sewage as reported by Metcalf and Eddy (1972) are shown in column (c) of Table 18. They also report that an industrial worker typically generates between 15 and 35 gallons of sewage per day. In addition to the 165 workers at the terminal site, approximately 30 longshoremen and other workers would be on the dock during ship berthing. Sewage generated on the dock would be trucked or pumped to the upland terminal septic system. Based on these considerations, expected pollutant loading due to sewage from the export facility is presented in Table 19.

Proposed treatment methods for sewage and surface runoff would be effective in eliminating materials that are associated with high BOD. These materials would be removed by settling and skimming mechanisms in the containment pond and septic tank. Suspended solids would be removed by ground percolation. Land application is effective in reducing levels of coliform bacteria, nitrate, ammonia, and phosphate from wastewaters allowed to percolate into the ground. In a study conducted in a populated area of the Chambers Creek drainage, eight miles north of the DuPont site, 10-fold reductions in coliform bacteria and 30-fold and 60-fold reductions in nitrogen (nitrate and ammonia) and total-phosphorus levels, respectively, were achieved by soil processes (DeWalle and Schaff, 1980). Biologically-mediated processes were thought to be responsible for decreases in groundwater levels of nitrate and ammonia, while physical adsorption was thought to be the dominant mechanism responsible for decreased total-phosphorus levels. Nitrogen and phosphorus levels in the Chambers Creek study are comparable to values reported for Sequalitchew Creek during the baseline studies (Thut et al., 1978). Based on these considerations, it appears unlikely that percolating waters from the proposed facility would measurably affect inherent nitrogen and phosphorus levels. It should be noted, however, that relatively high nitrate levels periodically reported for wells and Sequalitchew Creek in the baseline studies were unexplained but could be due to site contamination with sodium nitrate used in DuPont Company explosives manufacturing, and aggravated by low water flows during 1977, a year with notably low precipitation (Thut et al., 1978).

Bacterial action in the containment and infiltration ponds, and in the soil beneath the unlined infiltration pond and drainage ditches would remove some hydrocarbons and dissolved organic materials. Remaining dissolved materials would enter the groundwater. Volatilization and photochemical reactions would reduce hydrocarbon fractions to an unknown extent while runoff is held in the settling pond.

Since a portion of the lumber would be stored outside, the concern has been raised that fungicides (such as pentachlorophenol) used to preserve lumber may enter surface runoff from these storage areas. According to Cserjesi and Roff (1964), treated lumber exposed to weather loses some pentachlorophenol. Their three month experiment showed losses of pentachlorophenol of up to 40 percent on the exposed surfaces of the lumber stacks. However, interior boards lost very little of the chemical. Given the uncertainty of the future product mix at the terminal site, it is not possible to estimate the amount of pentachlorophenol that might be leached by rainfall; the rate, however, would be insignificant. More importantly, pentachlorophenol becomes highly immobilized in wood two days following treatment (Cserjesi and Roff, 1964), there would be at least a two day interval between treatment at Weyerhaeuser production facilities and storage at the proposed export facility.

Tropolone methyl ethers have also been mentioned as potential contaminants in log or wood storage runoff. Wood tropolones occur only in heartwood, not in bark or sapwood (Hillis, 1962). Thus, only minor quantities would be expected to leach from log or bark storage areas. Of the wood products Weyerhaeuser handles, less than one percent is western red cedar, the greatest source of tropolones. Also, much finished lumber, particularly red cedar, would be covered with waterproof paper. Thus, significant tropolone contamination would not be expected.

While it is not possible to predict levels of potential contaminants in groundwater and Sequalitchew Creek, the general level of impact would be small. No violations of state water quality standards would be expected. Nevertheless, Weyerhaeuser has agreed to monitor water quality of selected wells on the site and Sequalitchew Creek in a program satisfactory to the Washington Department of Ecology, and to promptly employ the necessary measures to halt any violations of water quality standards.

Routine monitoring of wells targeted for potable water supplies would be performed as required by Washington State Health Department regulations. It is likely that a well, located near the terminal area, would be developed as a potable water source. Elevation in chloride ion levels in certain wells could indicate saltwater intrusion caused by too rapid removal of groundwater. Some area wells already have elevated chloride ion levels. Monitoring the well in the terminal area may detect whether any significant chloride contamination has occurred as a result of terminal activities.

Other freshwater resources on the site would probably not be affected. No construction or development associated with the proposed project would occur within 2500 feet of Old Fort Lake. Furthermore, the proposed Memorandum of Understanding (MOU) between Weyerhaeuser and the U.S. Department of the Interior, Fish and Wildlife Service (FWS), would prohibit use of lands around Old Fort Lake for basic manufacturing or similar heavy use. The MOU states that Weyerhaeuser and the FWS would recommend that Edmond Marsh be designated "Conservancy" in the City of DuPont's Shoreline Management Master Program.

4.5.3 Marine Hydrology

Two minor impacts on marine hydrology could be expected. First, the new pilings dock would slightly alter local currents in the immediate vicinity of the dock. Dock design would, however, minimize impacts on current patterns and related sediment transport. The dock would be located parallel to the current, and pilings would be spaced far enough apart so as not to significantly change the current speed or direction. Second, ships serving the export facility would generate wake waves up to one foot high at full speed. Much smaller wakes would be generated as the ships approach at one knot. Vessel speed is much more important than vessel size in determining wake-wave height. These wakes are comparable to those generated by vessels that currently operate in southern Puget Sound (e.g. pleasure craft, tugboats, barges).

4.5.4 Marine Water Quality

Potential degradation of the water quality in the Nisqually Reach adjacent to the site evokes concern because water from the Reach is carried into the Nisqually Delta area by tidal action. Furthermore, significant shellfish and salmon resources are present in the Reach, particularly in and near the Delta. Effects of marine water quality degradation are discussed under Marine Biology (Section 4.8).

Any pollutants that would enter Sequalitchew Creek would flow into Nisqually Reach. Similarly, since groundwater moves from the upland site toward Nisqually Reach, groundwater contaminants would enter the Nisqually Reach. Dilution of any contaminants that did enter the Reach would probably be great enough so that no significant degradation of water quality of the Reach would be expected from these sources. It is possible, however, that during low tide, flow of water containing contaminants across the beach could result in temporary impacts on quality of water moving through beach sediments. With tidal inundation, rapid dilution would occur. As stated in Section 4.5.2, little contamination of water from the uplands would be expected. Thus, these water quality impacts would not be expected to be significant.

Also of concern are temporary increases in turbidity due to construction activities and water quality degradation due to stormwater discharge from the dock. Substantial but temporary increases in turbidity would be likely during removal of the old dock pilings and installation of pilings for the new dock. Because the sediments near the southern dock location are less consolidated than those near the northern dock location, pilings would have to be driven deeper, increasing the duration of construction-related turbidity (Section 4.1.5).

Ecological impacts of the turbidity increase would depend upon the season. Limiting construction activity to the period between March to June would minimize impacts to out-migrating juvenile salmon.

Runoff from the dock and its access road would be directed to a 158,000 gallon tank under the dock as described in Section 1.3. Treatment would remove settleable solids; sludge would be transported to a landfill. Oil would be removed to a level less than 10 ppm.

In addition to low levels of suspended solids and oil, the dock discharge would also contain low but detectable levels of heavy metals similar, perhaps, to those in urban street runoff. Estimates of the pollutant levels contained in road and dock runoff that would be delivered to the Nisqually Reach are tenuous. Studies have been found that deal specifically with the quality of road runoff. Corbett and Manner (1975) examined four sections of several rural highways in Ohio with average daily traffic (ADT) counts of 7,000-10,000 vehicles per day. Nearby undisturbed drainages were also measured as points of reference. Most toxic trace elements that were analyzed (iron, chromium, manganese, copper, zinc, nickel and cyanide) were not significantly higher in highway runoff than in runoff from the surrounding watersheds. However, cadmium and lead had significantly higher concentrations in highway runoff. Another study addressed artificially-induced runoff from a bridge near Tallahassee, Florida (Average Daily Traffic = 4200) (Irwin and Losey, 1979). Results shown in Table D-4 (Appendix D), indicate low levels of most parameters tested, with the exception of suspended solids (99 mg/l) and total phosphorus (0.15 mg/l), which were considered moderate. Chromium and mercury were undectectable in most cases. Of the six heavy metals for which data are available, only copper and zinc appeared to be appreciably above EPA 24-hour exposure criteria (Irwin and Losey, 1979).

Although the dock access road would be located in a rural setting, the results of these studies are not strictly applicable to the present project. While fewer vehicles would use the proposed dock access road, they would be larger and of a different nature. Runoff from the dock and its access road would be expected to have a higher BOD and suspended solids concentration from exposed cargos such as logs than those reported in Table D-4, Appendix D, by Irwin and Losey (1979). Treatment by the dock stormwater treatment system would, however, remove floatable material and much suspended sediment prior to discharge into Nisqually Reach. Levels of heavy metals in the discharged water cannot be predicted with available information.

Treated water from the 158,000 gallon tank would be discharged directly underneath the pier in 60 feet of water. Initial dilution of the discharge is estimated to be at least 100:1 based upon an empirical method for designing ocean outfalls (Metcalf and Eddy, 1972). Multiple discharge ports with smaller diameters would further increase dilution.

Ship discharges of sanitary sewage, ballast tanks, and bilge water are controlled by Coast Guard Regulations. Since the project does not include facilities for disposal of sewage or bilge water from vessels, there is only a minor risk of spills since no transfer of wastewater would take place and the ships are expected to follow Coast Guard regulations. During loading operations ballast water would be shifted within the ship and discharged at

the dock as necessary to maintain proper trims. Such discharges would be from tanks which carry clean seawater and would not result in the release of contaminants. Discharge of contaminants in ballast water would be in violation of permit conditions imposed by the City of DuPont (see Section 3.2.2).

The effect of other ship emissions, such as leaching of antifouling paint, upon marine water quality can be roughly estimated by calculating the volume of water moving past a vessel docked at the DuPont wharf. Larger vessels would draw 40 feet of water and may be assumed to impact the entire 60 foot water column. If one assumes enough water turbulence to effect mixing to 50 feet on either side of the ship as the current flows past, the initial mixing zone would have a cross-sectional area of about 6,000 ft^2. Mean water movement in Nisqually Reach is 0.12 knots to the north (Figure 22 illustrates that the instantaneous currents are usually considerably higher). At 0.12 knots, a flow of 1230 cfs in the assumed mixing zone would be expected. The flow of the nearshore water mass is greatly affected by shoreline configuration (points, embayments, etc.), changes in depth, and wind induced currents. Although these factors would substantially increase dilution with time, only the initial dilution zone is considered in this analysis.

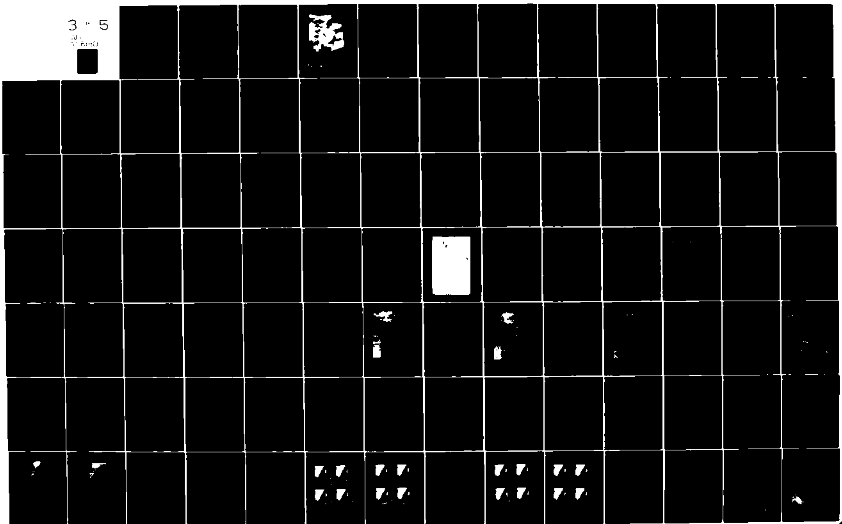
Young et al. (1974) studied the use of copper-based antifouling paints in Southern California. In a survey of shipyards, they determined that an average commercial ship was hauled for bottom painting about every two years. Approximately 190 liters of antifouling paint is applied with a copper content of 75 kg. Conservatively assuming that all the copper would leach to the marine environment in the intervening two years, the average emission rate would be 1.2 mg/sec. The resultant concentration due to initial mixing in the ship's vicinity, assuming this emission rate over two days, which would be the average duration of a ship's stay at DuPont, would be a copper concentration of 0.00004 mg/l. This is below present detection limits, and well below the published EPA water quality criterion for copper for protection of marine life (0.00079 mg/l) (U.S. EPA, 1976).

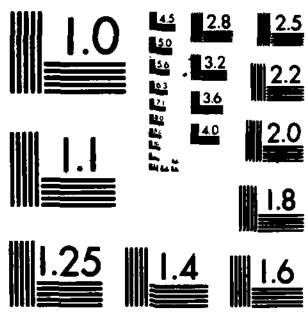
More recently a number of organo-tin compounds have been replacing copper as the antifouling agent in bottom paints. They provide superior antifouling properties over a longer period of time (Good et al., 1978). Tributyl tin, the most commonly used agent, persists in the environment for a considerable length of time, although it is readily adsorbed by clay particles and removed from the water column to the sediments (Good, 1979). A 5 mil (0.13 mm) paint coat is commonly applied to the ship hull. Thus, approximately 600 liters of paint containing 10 percent tributyl tin would be applied to a ship the size of the Weyerhaeuser M-class. This is equivalent to 69 kg of organo-tin. Once again, assuming conservatively that all of the tributyl tin would leach out in the vicinity of the DuPont dock during a typical three year paint life, the ship's hull would emit an average of 0.7 mg/sec of tributyl tin. The resultant concentration due to initial mixing in the vicinity of the ship is calculated to be approximately 0.00002 mg/l. For comparative purposes, Good et al. (1979) have shown tributyl tin acetate to be lethal to estuarine fish at concentrations between 0.02-0.10 mg/l, while Chliamovitch and Kuhn (1977) observed a 50 percent mortality of trout exposed

AD-A116 180 URS CO SEATTLE WA F/G 13/2
WEYERHAEUSER EXPORT FACILITY AT DUPONT. VOLUME I.(U)
MAY 82

UNCLASSIFIED NL

3 of 5





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

for 96 hours at 0.03 mg/l. The concentration of organo-tin emitted by a ship at DuPont would be on the order of 1000 times below acute lethal concentrations and unlikely to exert any acute effects in the vicinity of the dock.

Very little is known, however, about the ecological effects of chronic exposure to low levels of heavy metals in aquatic environments. The sediments are the major repository for metallic pollutants, sometimes containing as much as 99 percent of the metals present in the aquatic environment (Chapman et al., 1979). Most of the copper, for example, would be adsorbed or co-precipitated onto the sediments and other particulate matter bound to organic substances. Long-term accumulation of copper or tin in sediments could be expected to result from these emissions; the degree to which these substances would accumulate is unknown but expected to be slight. Its bioavailability would be low (Chapman et al., 1979). Copper, like other heavy metals, could be slowly remobilized from the sediments by physical-chemical processes and through disturbances of sediments by burrowing animals. Subsequent entrance into detritus-based food webs is possible. Copper, an essential trace element for animals, is bioaccumulated; that is, it is found in organisms in higher concentrations than in the surrounding water or sediments. It may also be transferred along the food chain, but it is not biomagnified (EPA, 1979; Chapman et al., 1979; Mearns and Young, 1980). In other words, concentrations of copper would not be higher in organisms higher on the food chain. Lead, zinc, and tin, also, are removed from the water column to the sediments primarily by adsorption to particulate matter and subsequent settling. Slow remobilization may occur from the sediments, and bioaccumulation is documented for lead and zinc; however, *biomagnification* in the food chain has not been demonstrated (Chapman et al., 1979; EPA, 1979; Mearns and Young, 1980).

Ships would be docked in water at least 60 feet deep. Because this is 15 feet deeper than the design draft of the largest ship at extreme low tide, little disturbance of the bottom sediments would be expected. As a result no resuspension of sediments containing heavy metals would be expected.

The shoreline at the dock is dynamic; however, it is steep enough that no buildup has been observed. No change in water depth would be expected from construction of the facility; therefore, no dredging would be required. Any sediment buildup would occur only immediately around pilings.

Weyerhaeuser has agreed to monitor Nisqually Reach periodically for one year following construction, according to a monitoring plan satisfactory to the WDE, and to take prompt action to control any observed violations of water quality standards.

A collision or other vessel casualty could cause a major oil spill. The probability of a spill resulting from the increase in vessel traffic would be small, as discussed in Section 4.11. If, however, a large spill occurred, marine water quality would be degraded for an unknown time even after oil clean-up and dispersal. In addition to coverage of the water surface,

some petroleum components would dissolve in the water column. However, the principal fuel, bunker oil, is a mixture of the heavier oil fractions with the great majority of the compounds in the greater than C-30 (greater than 30 carbon atoms) range. Such compounds have a very low solubility in water (less than 0.002 mg/l) and little would go into solution; most would be dispersed by mechanical means. Given the active currents in the Reach, water quality impacts would be temporary except in nearshore waters and substrate in the intertidal zone.

Diesel fuel, more toxic than bunker oil, is used for dockside power generation and for nearshore maneuvering. The volume of diesel fuel carried by freighters, however, is very small compared to bunker oil.

Following cleanup and dispersion of the more obvious components of a spill, petroleum hydrocarbons would be released into the water column from nearshore sediments as a result of sediment disturbances, caused by wave action, and the actions of benthic organisms such as clams and burrowing worms. These petroleum hydrocarbons could remain in fine-grained sediments for long periods without being biodegraded by microorganisms. The presence of anoxic (without oxygen) conditions to within one centimeter of the surface in fine-grained habitats slows biodegradation considerably compared to rates under aerobic conditions (with oxygen) (Augenfeld, 1980). In these habitats, however, disturbances of sediments due to burrowing and feeding activities of worms and other benthic organisms may be significant in bringing hydrocarbons to the surface where aerobic conditions prevail. These resuspended petroleum hydrocarbons may then enter the water column and detritus-based food chains.

A more detailed discussion of oil-spill impacts on marine biota and habitats and the factors that modify these impacts is provided in Appendix L. Specific impacts of oil components on local flora and fauna are discussed in Section 4.8.

Development of an adequate contingency plan, as described in Appendix M, would also reduce the potential for marine water-quality problems. Such contingency plans would be developed by Weyerhaeuser and may be subject to approval by the Corps of Engineers prior to construction and again prior to operation of the export facility and approved by the Corps of Engineers. Storage of any petroleum products or toxic materials on the dock would be avoided to reduce risk of contamination.

4.5.5 Floods

None of the proposed structures would be located within the 100-year flood plain. No aspect of the proposed project would significantly alter any flood hazard.

4.5.6 Water Mitigating Measures

Weyerhaeuser is committed to the following mitigation to minimize impacts to water quantity and quality: (a) during construction of the access road along Sequalitchew Creek, erosion controls would be used to reduce

stream turbidity; (b) appropriate measures would be taken to ensure that roadside ditches do not become clogged; (c) water quality of selected wells, Sequalitchew Creek, and Nisqually Reach would be monitored according to a program satisfactory to WDE. Corrective steps would be taken to prevent continuations of any violations of water standards; (d) lands around Old Fort Lake would not be used for manufacturing; (e) a request would be made that Edmond Marsh be designated "Conservancy"; (f) before shipping operation, Weyerhaeuser would prepare a plan for control and cleanup of any spills of oil or environmentally hazardous materials; (g) storage of any petroleum products or toxic materials on the dock would be avoided; (h) construction access roads would be gravelled where necessary to minimize sediment runoff into Sequalitchew Creek or the Nisqually Reach; (i) provision for drainage under or through the reinforced earth road to the dock would minimize its potential interference with groundwater movement; (j) minimizing groundwater withdrawal by recycling would avoid significant changes in the flow of Sequalitchew Creek; and (k) construction monitoring of Sequalitchew Creek turbidity would identify periods when additional erosion control measures were needed.

4.6 TERRESTRIAL BIOLOGY

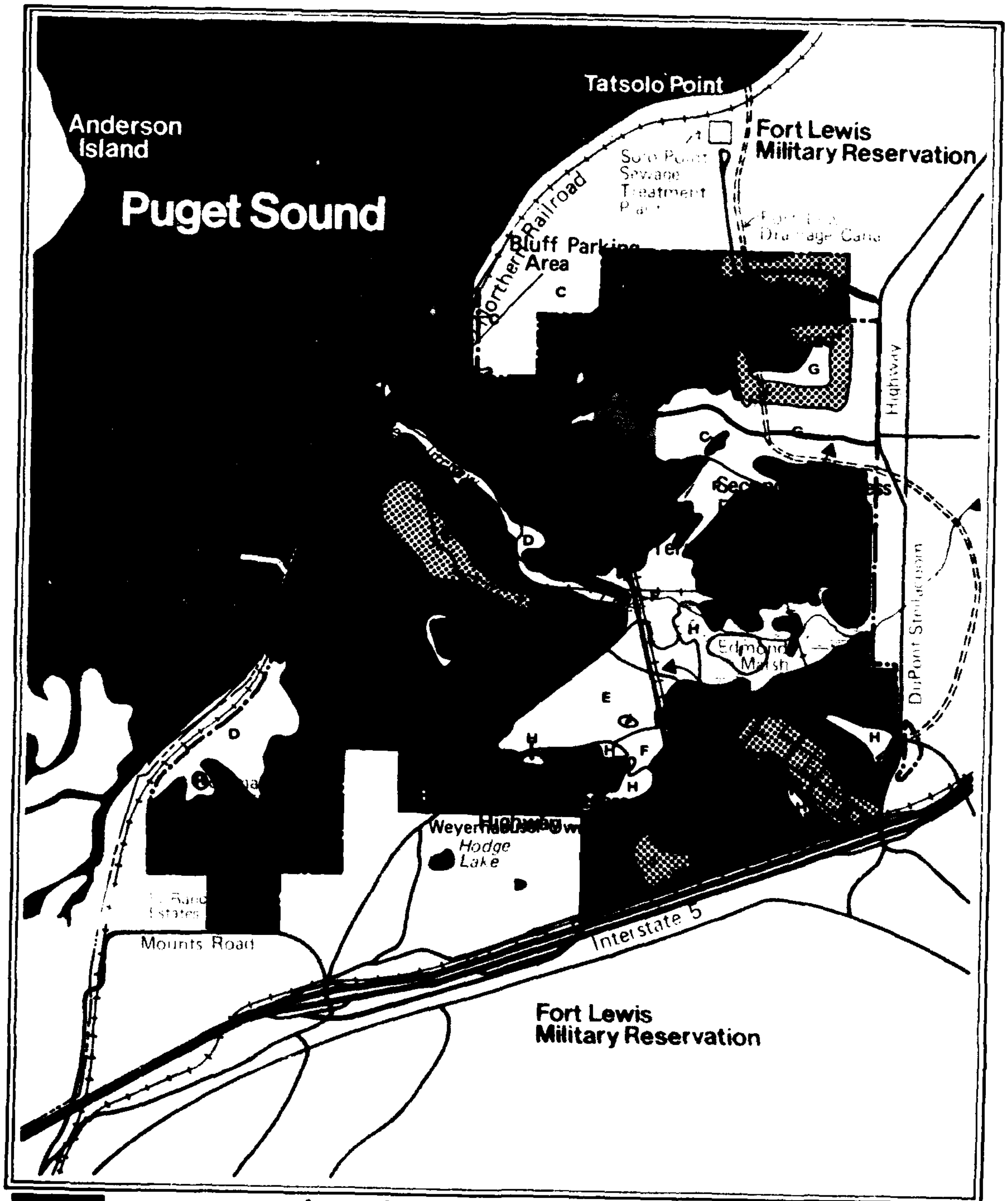
The major impact of the proposed project on the terrestrial biology of the DuPont site would be the elimination of 169 acres of vegetation and associated wildlife. As a productive and diverse upland area, the habitat site is considered to have regional significance. Impacts on terrestrial portions of the Nisqually Wildlife Refuge would be minor.

4.6.1 Flora - DuPont Site

Construction of the terminal area would require removal of vegetation from 120 contiguous acres of land. Habitat types that would be affected (Figure 50) include closed Douglas fir (66 acres), open Douglas fir (25 acres), prairie (19 acres), and successional scrub (9 acres).

The long-term vegetational productivity of this portion of the site would be lost. The area surrounding the terminal area would be subject to some fire risk because storage areas are potential fire hazards. (See sections on Risk and Fire Protection).

The 25 acres of land to be cleared for the primary access route include the types of habitat affected by the terminal area and oak savannah, a diminishing vegetative type and important habitat. The total area affected would include less than six percent of similar habitat on the DuPont site.



Scale in Miles

.25 .5 1

Legend

Douglas Fir Forest

- Successional Shrub
- Open Forest
- Closed Forest

G Prairie
H Fresh Marsh
I Bog

Other

D Mixed Forest
E Oak Savannah
F Pasture
K Salt Marsh

Cleared Area

Cleared Area

FIGURE 50
VEGETATION TYPES
IMPACTED BY THE PROPOSED
EXPORT FACILITY

Construction of the dock access road would eliminate three acres of mixed forest habitat from the ravine. While 140 acres of mixed-forest habitat occur on the site, most is adjacent to Puget Sound in the Hoffman Hill area. The 37 acres of mixed forest in the ravine provide a qualitatively different habitat because of the Sequalitchew Creek. Eight percent of this habitat would be destroyed by the proposed road.

A number of measures would be taken to reduce the adverse impacts of the proposed export facility on terrestrial biota. Denuded portions of construction corridors would be replanted. Careful control of erosion at construction sites, particularly in Sequalitchew Creek canyon, would conserve topsoil important for successful revegetation.

Careful routing of the access route would minimize the loss of oak savannah habitat, a rapidly diminishing habitat type in western Washington.

The loss of 169 acres of productive wildlife habitat that would be cleared, would be mitigated indirectly by habitat preservation of several areas including Edmond Marsh and Sequalitchew Creek Canyon (see Section 3.3).

4.6.2 Nisqually Delta - Habitat/Flora

The only major construction or operational impacts of the project on Nisqually Delta habitat would be those due to accidental spills. In such an event, environmental impact to the Delta would occur primarily below the mean higher high water (MHHW) elevation. Impacts to the marsh biota are discussed in Section 4.8.9.

4.6.3 Birds - Dupont Site

The proposed project would affect birds through direct loss of habitat at the project site and disturbance of habitat adjacent to facility sites. Much of the habitat that would be lost is Douglas fir forest, which has the greatest density of birds. The dock access road would eliminate eight percent of the mixed forest habitat in the ravine. This habitat has the most diverse bird population on the site.

The red-tailed hawk nest in the canyon would not be affected, since it is 1,200 to 1,500 feet upstream from the point where the road would enter the canyon. Furthermore, red-tailed hawks have a higher tolerance for human activity than most raptors. U.S. Forest Service management recommendations do not restrict logging of trees used as nesting sites by red-tailed hawks (as long as breeding and fledging activities have been completed) (Jackman and Scott, 1975).

Increased noise and human activity would degrade habitat value near the dock access road. Bird populations presently using these would decrease. Displaced birds could not move to similar habitats nearby, since these areas are assumed to be occupied to their capacity or near their capacity by

resident birds and probably could not support the additional population. Populations of birds tolerant of human activities, such as starlings and house sparrows, would increase, especially in the terminal area.

The proposed export facility would be expected to have little impact on water birds unless a major oil spill occurred.

4.6.4 Birds-Nisqually Delta

The Nisqually Delta is a crucial stopover point for birds migrating along the Pacific Flyway. It is therefore important for maintaining population levels of many species. The highly productive mudflats and salt marshes provide a vital food source for these birds. Impacts on birds that use the Delta would be likely to be minor unless a major oil spill severely damages the mudflat and salt marsh habitat or a spill contacts the delta when many birds are present. (See Appendix L for a more detailed discussion on oil spill impacts.)

Noise and human activity during construction and operation of the facility would not be expected to significantly impact the total population of birds in the Delta. Many marshes and mudflats adjacent to highways support dense populations of feeding shorebirds and other species. Substantial ambient and impulse noise in the Delta area is already present from traffic on Interstate 5, trains on the Burlington Northern Railroad, and military training at Fort Lewis. Nonetheless, some sensitive species could be affected by increased activity on the dock or by the dock lighting. This could lead to a decrease in the populations of sensitive species and an increase in the numbers of tolerant species with similar habitat requirements (also see Section 4.9).

4.6.5 Mammals - DuPont Site

As in the case of the birds, major impacts would result from loss and degradation of habitat. Decreases in numbers of certain species would be expected.

The largest area of habitat loss would be the terminal site. The most important habitat loss would be a result of the roadway through the canyon to the dock. Construction in the canyon would do more than remove vegetation and associated wildlife habitat. The 30-foot retaining wall on the northern side of the creek would constitute an impassable barrier to large mammals, particularly deer. This would decrease range availability and reduce productivity. Data gathered during baseline studies (Melchiors and Motobu, 1978) indicate that deer on the site use the creek as a source of freshwater. The proposed project would eliminate access to the lower portion of the creek, substantially reducing the value of that resource and adversely affecting the wildlife dependent upon it.

Impacts on small mammals would be less significant. Small mammals require less territory than large animals and are better able to use small accumulations of water on leaves and in shallow depressions on the forest

floor. Nonetheless, the habitat value of the ravine is higher than any other portion of the site. During the baseline studies, more small animals were trapped there than in any other habitat on the site (Melchiors and Motobu, 1978).

In addition, road kills would be expected to increase during road construction and operations. This impact would affect both animals approaching the ravine from the north side and those using habitats along the primary and secondary terminal access roads. Fencing the roads to prevent animals from crossing the traffic would reduce this impact. Increased disturbance of the oak savannah habitat as a result of construction and operation of the primary access route may also adversely affect the western gray squirrel.

4.6.6 Mammals - Nisqually Delta

No significant impacts on mammals in the Nisqually Delta would be expected as a result of the proposed project. The increase in noise and activity is not considered likely to significantly affect haul-out behavior of harbor seals, which use mud-flat areas of the delta. Noisy human activities at distances greater than about 0.25 miles would not be expected to be disturbing (DeLong, 1980). A population of harbor seals regularly uses a haul-out area in San Francisco Bay located less than one kilometer from an oil refinery off-loading area (DeLong, 1980). Such observations suggest that DuPont dock activities would not significantly disturb harbor seals use of delta mud flats.

4.6.7 Amphibians and Reptiles

Amphibians and reptiles would likely be affected only on the project site. Impacts would result from direct habitat loss. The most important amphibian habitat on the site is the Sequalitchew Creek ravine, where the dock access road would be constructed. Construction of the road would eliminate eight percent of this habitat. In addition, migration of amphibians away from the stream would be blocked by the roadway on the northern side of the stream. A reduction in the amphibian population is a possible consequence. No impacts on reptiles beyond direct loss of habitat would be likely.

4.6.8 Endangered Species

Biological assessments were completed as required by Section 7(a)(2) of the Endangered Species Act of 1973 for the bald eagle (*Haliaetus leucouphalus*) and the white-top aster (*Aster curtus*), identified by the U.S. Fish and Wildlife Service (FWS) as listed or proposed for listing as endangered or threatened species (Appendix E). *Aster curtus* has been withdrawn from further consideration as threatened or endangered by the FWS since the completion of the biological assessments. Section 7 consultation with the National Oceanic and Atmospheric Administration has determined that no endangered or threatened marine mammal species would be affected by the proposed export facility. The letter from the Seattle District Corps of Engineers in Appendix E (dated 24 October 1980) constitutes the required biological assessment.

The results of the bald eagle assessment (Appendix E) indicate that the bald eagle would not be significantly affected by the proposed project. Regular site use by bald eagles is not indicated by the results of the study; more appropriate habitat exists adjacent to and near the DuPont site.

Any future use of the site by bald eagles for nesting would probably be centered around Old Fort Lake where they nested before. This area is at least 600 meters from those areas proposed for development. Therefore activity associated with the proposed development would appear to have only minimal impact on future nesting at Old Fort Lake. The Weyerhaeuser-FWS MOU would restrict use of the Old Fort Lake vicinity for industrial or other noisy activities.

Potential perching sites on the bluff south of Sequalitchew Creek would be far enough removed so that activities associated with the proposed development would not greatly impact perching bald eagles except, perhaps, along the bluff adjacent to the dock access road and dock area. The proposed Weyerhaeuser-FWS MOU described in Section 3.3 would protect the forest along much of the bluff south of Sequalitchew Creek. Potential perching sites for bald eagles would, therefore, be retained, since by this MOU clear-cutting of the forested strip would not be allowed and selective logging must receive permission from FWS.

Since the locations on the DuPont site where white-top aster was found occur close to, but outside the areas of proposed development, the biological assessment (Appendix E) suggests that little or no impact on the white-top aster would be expected.

4.6.9 Terrestrial Biology Mitigating Measures

Weyerhaeuser has committed to the following mitigation to minimize impacts on terrestrial biology: (a) implementation of a Weyerhaeuser - FWS Memorandum of Understanding, that limits development of certain sensitive areas of the site, would reduce habitat loss and disturbances to wildlife on the DuPont site and portions of the Nisqually Wildlife Refuge; and (b) replanting denuded portions of construction corridors.

4.7 FRESHWATER BIOLOGY

No significant impact on freshwater biota on and near the DuPont site would be expected from the proposed project.

4.7.1 Sequalitchew Creek - Habitat

The only impacts to stream habitat would be probable short-term increases in turbidity due to construction of one culvert crossing and the reinforced-earth roadway constructed down the Creek Canyon. Modification of the stream-bank by placement of the culvert would permanently eliminate streambank plant communities and modify the stream habitat to be less suitable for aquatic plants as a result of decreased light availability.

4.7.2 Sequalitchew Creek - Flora

The most probable impacts on aquatic flora would be those caused by construction disturbance where the primary access route crosses Sequalitchew Creek (See Figure 6). Some attached and emergent aquatic plants would be removed during construction. This impact would be local; plant communities in which some plants were killed or trampled would probably recover within one season. Increased turbidity resulting from culvert construction would temporarily reduce photosynthesis of aquatic plants by reducing available light. Settled material on plant leaves would interfere with gas exchange.

Little impact to aquatic flora is expected in the lower reach of Sequalitchew Creek since no disturbance of the creek bed would be expected and removal of vegetation for the dock access road would not increase the amount of sunlight reaching the stream. Limiting construction in Sequalitchew Creek Canyon to the period between June and September, the low flow season, would minimize sediment transport and corresponding turbidity impact in the lower portions of the Creek.

4.7.3 Sequalitchew Creek - Fauna

Construction of the dock access road would eliminate approximately eight percent of available amphibian habitat in Sequalitchew Creek Canyon. In addition, the road would be a barrier to amphibian movement. No impacts, however, to amphibian breeding or feeding areas near Sequalitchew Creek would be anticipated.

Construction of the main access road across Sequalitchew Creek would eliminate existing benthic invertebrates at the crossing. Recolonization of the crossing area by benthic invertebrates leading to the formation of a similar community to that lost would be expected following construction.

Resident and anadromous fish would not be significantly affected by the construction or operation of the project, provided that construction of the crossing does not occur during the spring when juvenile out-migration from Sequalitchew Lake or intragravel development might be affected. Construction during the months of June-September would result in the least impact. Erosion-control measures would minimize turbidity and sedimentation and related impacts on fish.

Adverse impacts on the animals in Sequalitchew Creek would be minimized by the mitigating measures discussed in Sections 4.1 and 4.5. These measures would minimize turbidity, sedimentation, and other water quality degradation.

According to the proposed Weyerhaeuser-FWS MOU described in Section 3.2, Weyerhaeuser would grant a scenic and wildlife management easement to the State of Washington to protect this valuable wildlife habitat. Uses of the canyon would be limited to recreational and research uses. Only selective logging would be permitted by the MOU, and, then, only if cutting is conducted so that a forested appearance is maintained. The results of the MOU then would mitigate damage to wildlife habitat and water quality of Sequalitchew Creek.

4.7.4 Old Fort Lake

No adverse impacts to Old Fort Lake are expected. All construction and operational activity would be over 2,500 feet from the lake (Figure 6).

4.7.5 Nisqually River

No adverse impacts on the Nisqually River would be expected. A major oil spill, considered improbable, could impact riverine habitat. (See Section 4.6.2 for discussion of impacts of a major oil spill.)

4.7.6 Freshwater Biology Mitigating Measures

Weyerhaeuser has committed to the following to minimize impacts to freshwater areas: (a) construction of the road across Sequalitchew Creek to minimize turbidity during low flow conditions (June-September); (b) perform only selective logging within areas designated in the MOU; (c) grant an easement to the State of Washington to protect wildlife habitat; and (d) limit uses of the canyon to recreational and research uses.

4.8 MARINE BIOLOGY

The proposed project would slightly increase the risk of an oil spill in southern Puget Sound, including Nisqually Reach. Oil spill risk resulting from operations of the proposed facility is discussed in Section 4.11. Potential oil impacts on marine biological resources of the Nisqually Reach and Delta are discussed in this section and in more detail in Appendix L. Other impacts include construction-related increases in turbidity and destruction of invertebrates living both in areas where pilings would be driven and on existing wharf pilings. The food source for fish populations that prey on wharf-piling organisms would be reduced temporarily until new, ultimately larger populations of food organisms were established on the new dock pilings. Adverse impacts on phytoplankton and zooplankton near the diffuser for discharge of treated runoff would be localized and of little biological significance. Expected hydrocarbon levels in the discharge would not exceed 10 ppm and with an expected 100:1 initial dilution, these levels would be well below those reported as eliciting acute lethal and sublethal responses in phytoplankton (Appendix L).

In the event of runoff from the dock and dock access road in excess of the capacity of storage facilities, bypass of untreated runoff would occur, resulting in higher concentrations of hydrocarbons, suspended solids, and heavy metals, such as lead and copper, entering the Reach. Exceeding capacity would be expected to occur only rarely, since capacity of the storage tank is based on the most intense rainfall expected during a 30 minute period in 25 years. In this event, impacts on plankton and other biota would depend on actual concentrations, tidal conditions, weather conditions and time of year, and thus are not predictable. Impacts would be most adverse between March and June when juvenile salmonids occur along the DuPont shoreline.

Regarding food web interactions, an adverse impact on any one species or group of species may have severe consequences for other species that depend on the first for food. Food web impacts would be mitigated by measures cited in Section 4.5. The most important measures would be those that would minimize release of petroleum products. Development of workable contingency plans for oil spills would reduce adverse impacts on the marine ecosystem in the event of a spill.

There is a potential for bioaccumulation of some of these contaminants in organisms and for the transfer of such materials to other organisms in the food chain. Although fishes and crustaceans are capable of accumulating concentrations of petroleum hydrocarbons 200 to 300 times greater than in seawater, no evidence is available that biomagnification of hydrocarbons occurs at higher trophic levels (Simenstad et al., 1979). [Bioaccumulation of copper, lead, and zinc also occurs in marine organisms, and transfer of these metals along the food chain has been documented; no evidence is available, however, that indicates these substances are biomagnified at higher trophic levels (Chapman et al., 1979; EPA, 1979; Mearns and Young, 1980). Although fish accumulate little lead in edible tissues, mussels, which are found in the wharf piling community, accumulate high lead levels in edible tissues (EPA, 1979). Oysters also accumulate lead in high concentrations in edible tissues; oysters, however, do not occur sufficiently close to the project site to be of concern.]

4.8.1 Intertidal Habitat

Turbidity caused by removal of the existing wharf and driving of pilings for the new dock would physically disrupt intertidal habitat killing some of the infauna and relatively nonmobile epifauna. Most construction would be done from barges; direct physical damage to the beach due to equipment would be minimized, although some disturbance would be expected. No significant operational impacts to intertidal habitats would normally be expected. Low levels of hydrocarbons in treated runoff discharged near the dock would be unlikely to accumulate in intertidal sediments along the DuPont shoreline due to dispersion by wave action and currents, as well as the relative lack of fine sediments in the intertidal zone near the proposed dock. Some accumulation of hydrocarbons in the finer sediments of Sequalitchew Creek Delta would occur.

4.8.2 Intertidal Flora and Fauna

Mortalities of flora and fauna would result from pile driving and from crushing and disturbance by construction equipment operating in the beach area. Since most work would be done from barges, impacts are expected to be minimal. As most intertidal life is represented in the plankton, recolonization of disturbed habitats would begin immediately following construction. Adverse impacts on phytoplankton and zooplankton near the diffuser (for discharge of treated runoff) would be localized and of little biological significance. Expected hydrocarbon levels in the discharge would be limited to 10 ppm by treatment. With an expected 100:1 initial dilution, hydrocarbon levels would be well below levels reported for acute lethal and sublethal responses in phytoplankton (Appendix L). Rapid recolonization of adjacent, disturbed habitat after construction would be expected.

4.8.3 Subtidal Habitat

The major impact on subtidal habitat adjacent to the DuPont site would be additional shading by the proposed new 1300- by 140-foot dock. In addition, this habitat would be temporarily disrupted by the driving of pilings for the new dock and access road.

4.8.4 Subtidal Flora

Impacts on macroalgae would be minor primarily because no dredging is proposed. Productivity of subtidal areas shaded by the dock would decrease. Flora in the immediate vicinity of the dock pilings would be destroyed during dock construction. In the event of an oil spill, tissue contact with high concentrations of oil could cause acute damage to macroalgae. A lower level source due to contamination of sediments and subsequent slow release of soluble hydrocarbons, could cause inhibition of growth and interference with reproduction (Johnson, 1980).

4.8.5 Subtidal Fauna

The impacts on subtidal fauna would be slight as no dredging is proposed and major oil spills are unlikely. During construction, piling removal and installation would destroy some subtidal organisms in the vicinity of the existing DuPont wharf. Sessile benthic forms, such as clams and worms, living in the areas where pilings would be driven would be destroyed but this destruction would not have a significant impact on the local benthic community.

The potential oil-spill impact on subtidal species cannot be quantified; however, the light-weight toxic constituents of oil are unlikely to disperse to the subtidal area in toxic concentrations because of the relatively calm nature of Puget Sound. Some heavier fractions, as well as lighter fractions, could become mixed downward to the sediments as a result of mixing by winter storms. It is possible that some of these hydrocarbons could become incorporated into sediments, with subsequent slow release to the water column. Such hydrocarbons could enter the food web.

4.8.6 Special Habitats

4.8.6.1 Wharf Pilings. Expected impacts include destruction of existing habitat and associated communities, and creation of a new habitat suitable for colonization. The short-term impact would be a loss of habitat, while the long-term impact would be a net increase in available habitat.

The piling community on the existing DuPont wharf would be destroyed with the piling removal. Marine life associated with the pilings, such as crabs, pile perch, sculpin and other motile forms would relocate to similar habitats, such as rocky areas and kelp beds, if available. Some population decline would occur if similar habitats nearby are near or at their carrying capacity and unable to support the additional population. A similar community would be expected to colonize the concrete pilings of the new dock and be well established within two years. This community would be exposed to low levels of toxicants and petroleum products as discussed in Section 4.5.4.

4.8.6.2 Eelgrass Beds. Increased suspended materials due to construction would not be expected to impact the small eelgrass bed immediately south of the existing wharf (Figure 31). No operational impacts on this bed would be expected. All sizeable beds are found along the face of the Nisqually Delta, approximately 1 to 1.5 miles from the Weyerhaeuser site; no serious impact on these beds would be expected (Appendix L). In the event of an oil spill in the vicinity of the DuPont site, there is a small probability that oil would reach the eelgrass beds near the Delta and McAllister Creek (Figure 30). In this event, oil covered blades would be shed and regeneration from protected roots and shoots would occur following oil dispersal. Heavily oiled eelgrass beds would recover slowly or not at all. Organisms dependent on the protection and cover of eelgrass stands would be severely impacted. Nursery and food source functions would be greatly reduced.

4.8.7 Nisqually Reach

During dock construction, the primary impact to fish would be an increase in the level of turbidity in the immediate vicinity of the dock as old pilings are removed and new ones are driven. Noise and vibration from pile driving, dock demolition and a substantial increase in boat and other human activity would also result, which may affect local fish activity. This impact would cease at the conclusion of this phase of construction. Avoiding demolition of the existing dock and pile driving for the new dock during the period from March 15 to June 15 would minimize impacts on outmigrating juvenile salmonids.

Operational impacts upon salmonid fish would consist of three basic types: (1) those associated with the physical location of the dock, (2) those resulting from one or more major, or several minor, fuel spills; and (3) those resulting from bioaccumulation of heavy metals. Due to the nature

of the project (not oil related), the runoff collection and treatment system, and the tidal exchange characteristics of the Reach, significant chronic impacts to Nisqually Reach food webs from oil pollution would be unlikely. Because of its physical (shallow mudflats, calm waters) and biological (estuarine and nursing area, wildlife refuge) characteristics, the Nisqually Delta is susceptible to significant environmental damage should an oil spill occur. Tables 20 and 21 summarize effects of oil on populations and communities, and major ecosystems, respectively.

As discussed in Section 4.11, (1) the increased risk of a significant fuel spill (greater than 2.4 barrels or 100 gallons) in southern Puget Sound due to ships calling at DuPont would be less than one percent in any given year, and (2) the frequency of a spill greater than 2.4 barrels (100 gallons) would be once in every 103 years to 325 years depending on the number of port calls. The most probable cause of a major spill would be the collision of a DuPont bound vessel with a loaded tanker or fuel barge in Nisqually Reach.

Quantitative predictions on the numbers or species of plant or animal life that would be seriously affected by a spill are dependent upon the nature of the spill and the nature of the organisms comprising the community. Studies have shown that impacts are dependent on species, weather, substrate, spill volume, season, oil type and other factors.

Wind analysis in Nisqually Reach has shown that there is a much greater probability of wind from the south (from two to eight times as great) than from the north. This indicates a low probability that oil from a given spill would reach the Delta. A spill in the dock vicinity on a flood tide with strong northerly winds could, however, drive oil to the Nisqually Delta area in as little as two hours (Storie, 1979).

Should a spill occur, the season in which it occurs would have an important effect on the significance of the spill. The two most critical periods appear to be spring and fall. If oil were spilled, it would most likely be the heavy distillate used to power the ships. This oil is less soluble and generally less toxic than crude oil and its lighter fractions. Biological impacts would be most significant in the upper water column and intertidal areas.

The impact of a fuel oil spill on returning adult salmonids and most marine fish would probably be minimal since the most toxic components of the heavy oil used to fuel the ships would either volatize rapidly or sink after floating for variable periods of time (depending on molecular composition). Many fish species can avoid petroleum accumulations. Such species include adult salmon, pink salmon fry, goby and perch. Other species do not apparently avoid petroleum hydrocarbons. Examples include rainbow trout and English sole (Appendix L).

Table 20

SUMMARY OF EFFECTS OF OIL ON POPULATIONS AND COMMUNITIES

Community or Population Type	Expected Degree of Initial Impact		Expected Recovery	
Plankton	Light to Moderate:	Impact dependent on chance event of contacting floating slick. Decrease in population densities may have effect on local productivity. Greatest danger to small local breeding populations composed of larval fish.	Fast to Moderate:	Effective reproductive and dispersal mechanisms for most phyto- and zooplankton in open waters (populations dense, widely dispersed; individuals ubiquitous, prolific, grow quickly to maturity). Local breeding populations of larval fish and shellfish may take much longer to recover.
Neuston	Unknown:	Chance of contact high since communities exist on or near surface. Contamination reported, but effects unknown.	Unknown:	Ecology poorly understood.
Benthic Communities		Mortalities lead to decrease in population densities and age distributions; changes in species abundance and distribution; imbalances between interacting populations.		
Rocky Intertidal	Light: (with exceptions, e.g., *Tampico Maru* spill)	Hardiness of organisms. Most damage from coating leading to suffocation or loss of purchase on substrates.	Fast:	Oil rapidly removed by waves. Populations rapidly restored since individuals grow and reproduce rapidly.
Sandy or Muddy Intertidal	Moderate:	Impact increased by persistence of oil in unconsolidated substrates. Chance for greater mortalities since infaunal organisms may be more sensitive than rocky intertidal organisms that have developed defense mechanisms for living in rigorous and variable environments.	Moderate:	Persistence of oil in sediments prolongs toxic effects.

Table 20 continued

Community or Population Type	Expected Degree of Initial Impact		Expected Recovery	
Subtidal, Offshore	Heavy:	Impact increased by persistence of oil in unconsolidated substrates. Chance for greater mortalities since many subtidal organisms may be more sensitive than rocky intertidal organisms that have developed defense mechanisms for living in rigorous and variable environments.	Slow:	Persistence of oil. Possibly, slow rate of biological succession for complex, highly structured communities found in some subtidal areas where abiotic factors have been historically constant.
Fish	Light to Moderate:	Possibility of avoiding spills; some resistance offered by mucous coating. Greatest danger to local breeding populations in confined waterways (increased chance of contact; sensitive larval forms present; adults display complex breeding behavior) or benthic fish in heavily polluted substrates.	Fast to Moderate:	Effective reproductive and dispersal mechanisms for most pelagic populations (fast immigration of larvae and adults). Local breeding populations may take much longer to recover.
Birds	Heavy:	Mortality from ingestion of oil droplets and coating (loss of body heat and buoyancy). Mortalities lead to decrease in population densities.	Slow:	Individuals long-lived; low fecundity; gregarious behavior increases chances of losing entire population.
Mammals	Light:	In comparison to other groups, marine mammals not extremely abundant along most coasts. Impact dependent on chance event of small population contacting floating slick. Due to mobility, most mammals can probably avoid heavily-polluted areas. Conclusive evidence of mortalities, due to oil pollution, is rare. Possible effects include ingestion of toxic oil droplets during grooming; loss of thermal insulation and/or waterproofing, due to coating; and irritation of eyes and exposed mucous membranes. Eye irritation reported after <u>Arrow</u> spill[51] and spill in Alaska.[52]	Slow, if Population Seriously Affected:	Individuals long-lived; low fecundity—hence, time for recovery increased. Also, some mammals near extinction. However, no supportive evidence for loss of entire populations as result of oil pollution.

Source: Hyland & Schneider, 1978

Table 21

SUMMARY OF EFFECTS OF OIL ON SOME MAJOR ECOSYSTEMS

Type of Environment		Expected Initial Impact		Expected Recovery
Open Estuarine Areas, Bays, Channels, Harbors	Moderate to Heavy	Chronic oil may depress populations of fish and some benthos; or induce changes in species abundance and distribution. Spilled oil effects dependent on time of year (spawning, migration, etc.) and oil's persistence.	Fast to Slow:	Dependent on flushing characteristics, route to benthos, shoreline characteristics, and community stability. Individual year classes of larval fauna may be severely impacted.
Wetlands: Marshes and Mangroves	Heavy:	Potential serious threat as result of vulnerability to spills and significance of estuarine functions (nursery and breeding grounds; high productivity; basis of detritus food chain). Several effects noted: faunal mortalities leading to decreases in population density, changes in species abundance and distribution; damage to marsh grases after repeated exposure, and decrease in productivity; damage to mangroves and neighboring grasses.	Moderate to Slow:	Persistence of oil in sediments prolongs toxicity. Yet, once removed, biological succession may be moderate in some areas, since generally organisms reproduce and disperse fairly rapidly. Mangroves particularly complex and may take long to recover. Marsh area at West Falmouth still slightly affected 5 years after spill.

Source: Hyland and Schneider, 1978

In the event of an oil spill, migrating steelhead (rainbow trout) and English sole would not avoid the spill area; mortalities would be expected.

If such a spill were to occur during the period of peak juvenile salmonid outmigration (March-June), it is possible that large numbers could be severely impacted. In addition to being generally more sensitive to toxicants than adults, juveniles inhabit shallow estuarine and near-shore waters during their early life stages and would therefore be in close proximity to, or in direct contact with fuel components that would be carried inshore. Significant impacts to juvenile salmonids and other nearshore fish would also occur due to impacts on epibenthic organisms that comprise the majority of food items for these fish (Fresh et al., 1979). More information on the effects of petroleum on fish and their prey is contained in Section 4.8.9 and Appendix L.

The proposed dock could impact juvenile salmonids in two basic ways: (1) it could provide prime habitat for predators of juveniles and (2) it could evoke an avoidance reaction forcing the juveniles into offshore surface waters where they would be exposed to increased predation. Studies carried out at the U.S. Navy Trident Submarine Base in Hood Canal, Washington, by the University of Washington Fisheries Research Institute indicate, however, that most juvenile salmon swim between the pilings (Prinslow et al., 1980). If these findings indicate typical juvenile salmonid behavior in Hood Canal then the DuPont dock pilings would not likely present a significant obstacle to juvenile salmon. The effects of occasional 24-hour operation and dock lighting are not certain. Dock lighting could attract many fish species with resultant increased predation upon juvenile salmon. Plans call for dock lights to be so directed and shielded as to minimize lighting of surrounding waters (Section 4.10), and for no loading from 11 p.m. to 7 a.m. except under unusual circumstances.

Within one to two years a piling-associated invertebrate community would be established at the new dock. There is concern that fish predators associated with this community would have a significant predatory effect on migrating juvenile salmonids. Surveys performed incidental to the baseline work conducted by Fresh et al. (1978) indicated that salmonids did not comprise a major portion of the diet of fishes associated with the wharf. However, these fish surveys were not designed to predict project impacts on salmonid predation; sampling was not performed at night when dogfish sharks and ratfish might enter the piling area from deeper waters. Although it is possible that the larger dock would result in increased predation, these incidental observations and those of other studies (e.g., Cardwell, 1979) suggest that this would not be a major impact at DuPont.

Significant disruptions in habitat of local marine fishes would be likely only in the presence of a major petroleum spill. If a spill occurred, impacts upon marine species would be of a similar nature to those discussed for salmonids. Those utilizing the shallow areas, particularly in the Delta, would be most impacted. Bottom dwellers, such as flatfishes, would be partially isolated from the spill and impacted the least, but mixing by storms and sinking of heavier oil fractions could expose these fish to petroleum hydrocarbons. Thus, some level of impact would be expected. Pacific herring was one of the most abundant non-salmonid species caught in the nearshore townet surveys carried out by Fresh et al. (1979), suggesting substantial use of the DuPont shoreline by that species. These shoreline spawners could be severely impacted by a large spill during the spawning season.

4.8.8 Fisheries in Southern Puget Sound

Although no major long-term impacts on salmonid populations, habitats, or salmon enhancement programs would be expected, the dock and increased shipping would affect, in the long-term, treaty Indian and other fishermen operating in Nisqually Reach.

The proposed dock location would occur in a known milling area for coho and chum salmon (Section 2.8.8.1). This area is a portion of the Sequalitchew harvest area of the Nisqually Tribe.

The proposed dock would extend farther southwest (approximately 800 feet) and slightly farther northeast (approximately 125 feet) than the existing wharf. An approximate 0.6 percent reduction of the open stretch of water north of the proposed dock to the northern tip of Ketron Island would occur. Many gillnet drifts begin or end at Tatsolo Point (1.5 miles north of the existing dock). The effective reduction in this area would be approximately 2 percent. Therefore, the dock would have a relatively small effect on the area accessible to gillnetters north of the proposed dock. An approximate 25 percent reduction would occur in the length of the open stretch of water between the proposed dock and the jetty, which marks the southwest boundary of the Nisqually Tribe harvest area. In this area, the dock would substantially interfere with netting operations by Indian fishermen who would continue to fish southeast of the dock. Tribal fishing operations have historically been more intensive, however, north of the existing dock, probably due in part to the presence of a milling area for coho and chum salmon in that area (Figure 33).

If sited at the alternate location, the proposed dock would: (1) extend approximately 1,000 feet farther north than the existing wharf; (2) reduce the open stretch from the dock to the northern tip of Ketron Island by about 5 percent; (3) reduce the effective fishing area from the dock to Tatsolo Point by approximately 13 percent; and (4) increase by 400 feet the effective fishing area southwest of the alternative dock location by removal of the existing DuPont wharf.

Impacts on fishing activities would be compounded by the fact that just north of the dock is a milling area for coho and chum salmon returning to Sequalitchew Creek (Figure 32).

Increased freighter traffic would increase the risk of accidents involving fishing boats and nets, as discussed in Section 4.11, Risk. As presently conceived, ship arrivals and sailings would occur without regard to time of day. The risk of net entanglement or interference with fishing boats would be substantially greater during the hours of darkness when many Indian fishermen operate. Furthermore, a major spill, although unlikely, could interfere with fishing operations, making it difficult to fish without ruining gear.

Despite the loss of a small open water area currently used by tribal fishermen, and the slightly increased potential of accidents involving DuPont-bound ships and fishing boats and gear, the proposed dock and shipping activities would not be expected to cause interference with fishing operations that would result in impairment of the tribe's ability to satisfy their moderate living needs. The alternate dock, however, would result in a greater level of interference with tribal fishing operations as they currently are practiced. Whether or not that interference would substantially reduce catches is uncertain.

Normal operations would not be expected to significantly affect salmonid populations or habitats to an extent that would impair the tribe's ability to satisfy their moderate living needs. It is possible that a major oil spill would result in significant degradation of fish habitat that might reduce fish productivity in the area for several years. Such a "worst-case" event could affect tribal fisheries to a significant degree.

The project would not significantly impact recreational fishing (including shellfishing) in the area due to increased freighter traffic.

4.8.9 Wetlands

Neither the roads nor the upland terminal site would be constructed near any freshwater marshes at the DuPont site. The main access road would cross Sequalitchew Creek about one quarter mile downstream from Edmond Marsh. No impact upon freshwater marshes would be expected.

The temporary increase in nearshore turbidity due to piling replacement could affect the saltwater marsh near the mouth of Sequalitchew Creek. However, the marsh is separated from Puget Sound by a culvert running under the Burlington Northern Railroad tracks which greatly reduces the chance of nearshore water movement into the marsh. The impact would not be expected to significantly differ from the impact of the silt transport to the marsh via freshwater flow from the basin above. Contaminants present in dock runoff would be diluted to low levels by the time the water moved inshore and through the culvert on an incoming tide. No impact to the marsh would be expected from normal dock operations.

The small marsh could be vulnerable to small oil spills and would definitely be endangered should a large (greater than 50 gallons) spill occur. The culvert-channeled inlet would provide considerable protection from entry of wind-blown oil and the primary currents are parallel to the shore; however, entry of oil through the culvert is possible on an incoming tide.

The distance from the Nisqually Delta to the proposed dock site would render unlikely any construction or operational impacts upon the Delta. However, given a major oil spill, and with certain wind and tide conditions, oil could reach the intertidal and marsh portions of the Delta, resulting in serious impacts on marsh functions. These impacts are described in Section 4.8.10 and in Appendix L.

4.8.10 Other Ecological Impacts

This section briefly reviews some of the more general effects on the food web that would be likely if a major oil spill occurred in the vicinity of the proposed dock. (Lethal and sublethal effects of oil upon individual marine species are summarized in Appendix L.) The Marine Ecosystems Analysis (MESA) Program sponsored by the National Oceanic and Atmospheric Administration (NOAA) conducted a series of studies in northern Puget Sound and the Strait of Juan de Fuca to determine oil spill impacts on marine communities. Conclusions from one of these studies (Simenstad et al., 1979) are probably applicable to the Nisqually Delta and the nearshore waters along the DuPont shoreline.

Surface-dwelling and epibenthic zooplankton populations in the project vicinity would be significantly impacted in the short-term by an oil spill. Calanoid copepods, which dominate the zooplankton in this area, would be severely affected. They are the predominant food source for a number of neritic larval fishes such as the Pacific herring, smelt and sand lance. Such fish, if not themselves impacted by oil toxicity, might face a severe reduction in food availability. Maturing juvenile salmonids could also be significantly affected by loss of epibenthic plankton. This impact on zooplankton populations would be temporary given the extensive flushing within the Nisqually Reach.

If oil components reached the Nisqually Delta or the mouth of Sequalitchew Creek during periods of heavy juvenile salmonid migration, these salmon populations could be severely affected. In addition to being highly sensitive to oil, particularly during the transition period from freshwater to saltwater, juvenile salmon feed almost exclusively upon small invertebrates residing in the channels that form the marsh (Congleton and Smith, 1976). These food sources would be severely reduced in an oil-impacted area. Juvenile salmon would be more susceptible to mortality during their already critical early estuarine/marine life history that is typified by a naturally high mortality rate.

The MESA study (Simenstad et al., 1979) concluded that one of the most widespread impacts of an oil spill could come from a significant disruption of the detrital community. The potential for such an impact would be highest in the Nisqually salt marsh and tide flats and the smaller salt marsh at the mouth of Sequalitchew Creek. Direct damage to the plants or macroalgae in these areas would reduce much of the detritus source which forms the foundation of this important food web. Resulting reductions in the populations of the grazers and decomposers could lead to long-term alterations in the structure of the food web and/or its productivity. Populations of amphipods, cumaceans, shrimp, polychaetes and other detritivores would be greatly reduced. The impact upon higher trophic levels (juvenile salmon, herring, etc.) has already been discussed. With a reduction in available prey, the Delta would become a less suitable nursery habitat for a variety of fish species for an indeterminate length of time.

Although most marine organisms have the ability to metabolize or eliminate hydrocarbons, shellfish and fish may become tainted with an oily smell or taste, thereby reducing their recreational and commercial value (Simenstad et al., 1978).

Impact duration is difficult to estimate. Effective cleanup measures followed by replanting of impacted areas of emergent vegetation could result in complete marsh recovery within a few years, but may take longer. Recruitment of lost invertebrate detritivores and insects from adjacent areas could be high; recovery could be achieved in one to several years. If a massive kill of juvenile salmon occurred, the effects could last through several generations (3-5 years). The worst case would be if significant amounts of oil became buried in the sediments. Oil degradation would be greatly retarded and deleterious levels of hydrocarbons could be slowly released for a number of years (Appendix L).

Two years after cleanup of a spill on the St. Lawrence River, fish and wildlife communities had nearly recovered (EPA, 1979). In other studies, oil has been measured in sediments of marshes for as long as 6 to 7 years following a spill. Thus, long-term sublethal impacts to the community would be expected for a much longer period of time than indicated by the recovery of marsh plants (Simenstad et al., 1979). Damage caused by oil and cleanup operations could result in displacement of the dense root mat of marsh plants. Erosion could result in the removal of sediments accumulated over a period of perhaps several hundred years (Nyblade, 1979).

4.8.11 Marine Biology Mitigating Measures

Weyerhaeuser has committed to the following mitigation to minimize impacts to marine biology: (a) Weyerhaeuser plans to cooperate with the Nisqually Indian Tribe to determine the likely effects of the export facility, on Indian treaty fishing and plans to use its best efforts to seek agreement on measures to mitigate any anticipated impairment of their treaty rights; (b) mitigating measures to minimize impacts on water quality stated previously; and (c) the construction season for dock and access ramp would be determined in conjunction with the Department of Fisheries to avoid impacts on salmon outmigration and other significant fisheries resources.

4.9 NOISE

The proposed facility's impacts on the sonic environment of the DuPont area have been assessed in studies by Towne, Richards and Chaudiere, Inc. (TRC) (1980) and by Crain (1978). These studies indicate that significant increases in noise levels would occur on Anderson Island, in Nisqually Reach, and in the Nisqually Wildlife Refuge. Other areas would not be significantly affected.

No noise sensitive receptors would be located within 1,000 feet of the proposed facilities. The nearest residential area would be 1800 feet from the primary road and rail access and 4,400 feet from the terminal area. The northeastern boundary of the Nisqually Delta Wildlife Refuge would be 3100 feet from the southwestern end of the proposed dock and 3600 feet from the dock causeway (Figure 2). If the dock were constructed in the alternate location, its midpoint would be 3,800 feet from the northeastern boundary of the refuge.

During construction of the dock, pile driving would cause noise levels great enough to significantly interfere with outdoor speech in areas on Anderson Island (Crain, 1978). Because pilings would not have to be driven as deep if the alternative dock location were used, the duration of this adverse impact would be shorter. During construction of the other facilities, significant noise level increases would be experienced on the DuPont site. No modeling has, however, been performed to predict noise levels from the upland construction. Short-term construction-related noises are exempt from Washington Administrative Code (WAC) 173-60 noise regulations during daylight hours (0700-2200).

Operational noise impacts were assessed by comparing existing and predicted noise levels with Washington State standards and with guidelines issued by EPA. Information in the following discussion of potential noise impacts is taken from TRC (1980), unless otherwise indicated.

Sound propagation across Nisqually Reach from the mainland to Anderson Island was measured on six days considered potentially favorable for reinforcement. TRC (1980) found that during reinforcement conditions, a maximum reinforcement of 8-9 dBA can occur. Noise emissions from existing equipment and operations of other Weyerhaeuser facilities were measured, analyzed, and used to calculate future noise levels near Anderson Island and in the Nisqually Wildlife Refuge. Table G-5, Appendix G, summarizes predicted future noise levels in these areas. The following noise impacts would be expected absent any efforts to minimize noise through engineering design, equipment selection, or operational controls:

a. According to Crain, (1978), noise levels would increase in the railroad storage and unloading area due to the arrival, unloading, and departure of Burlington Northern (BN) trains. Noise levels would also increase in the access road corridor leading to the upland terminal. Ambient noise levels in the village of DuPont are

presently higher than the levels that would be generated by the access road, rail access, and operations in the terminal area. Therefore, residents in DuPont would not experience any increase in noise levels, except for more frequent whistle noise from rail traffic along the Burlington Northern track. Train whistles are exempt from Washington State noise regulations, although they may be annoying.

b. "Worst case" nighttime noise levels on Anderson Island, in Nisqually Reach, and the western part of the Nisqually Wildlife Refuge are predicted to exceed WAC noise standards by 7 dB. Daytime noise levels would be in compliance with these standards.

   "Worst case" noise levels would occur when winds toward the noise receptor (e.g. Anderson Island, Nisqually Wildlife Refuge) coincide with a temperature inversion. These conditions, which exist about 10 percent of the time in summer and about 20 percent of the time in winter, occur most frequently during the early morning and late evening periods of high noise sensitivity, when the proposed export facility would not be operating.

c. "Worst case" noise levels in the northeastern part of the Nisqually Wildlife Refuge would exceed nighttime WAC standards by 10 dB, during unfavorable reinforcement conditions. During the day, compliance with WAC standards would be marginal.

d. On Anderson Island, Nisqually Reach, and in the western part of the Nisqually Wildlife Refuge, predicted increases in nighttime noise levels and day-night sound levels (Ldn) would represent significant or very serious impacts according to the EPA Region X noise guidelines. Predicted increases of more than 10 dB in the northeastern part of the Nisqually Wildlife Refuge represent very serious impacts according to these same guidelines.

e. The large predicted increases in background and hourly maximum levels during "worst case" conditions could cause sleep interference on Anderson Island leading to frequent complaints.

   With windows partly open, the predicted "worst case" interior peak impulse noise levels would be about 73 dB from logs being dropped by stackers on the dock. A maximum of 20 trucks per hour would be unloaded on the dock. This noise would probably be more intrusive than existing nighttime impulse noise.

f. Noise impacts on wildlife at DuPont and the wildlife refuge are uncertain. The wildlife refuge is considered to be a class A EDNA receptor by the Washington Department of Ecology (TRC, 1980).

Criteria for evaluating noise impacts on wildlife have not been developed. The following effects are based on available information. Noise-sensitive species would be disturbed by increased noise levels and may abandon noise-disturbed areas. Such abandonment would probably lead to a loss of individuals of a species, since adjacent quieter habitats are probably already at carrying capacity. The displacement of noise-sensitive species would be long-term and a significant adverse impact. It is possible, however, that noise-tolerant species with similar ecological requirements could move into areas near the export facility as opportunities became available. Thus, while the populations of some species in the noise-affected areas of the DuPont site and neighboring Nisqually Wildlife Refuge would decline as a result of project construction and operation, populations of other species would increase. See Appendix G for further discussion of this topic.

4.9.1 Noise Mitigation

Certain design features of the facility would minimize noise impacts. Only the dock is on the shoreline; staging areas would be inland, where vegetative and other screening along the primary access corridor and around the terminal facility would shield the village, Anderson Island and the Nisqually National Wildlife Refuge from noise from upland activities. Hoffman Hill would further shield the eastern part of the wildlife refuge from noise from upland activities. Rubber-wheeled vehicles, which are quieter than vehicles on steel rails, would be used for transportation of materials on the site, except for the rail spur.

In addition Weyerhaeuser would employ a combination of some or all of the following mitigating measures to achieve compliance with WAC noise standards and to reduce noise as much below the standards as reasonably possible. The precise measures to be used would be determined during the detailed design work, which would occur only after all permits have been secured.

a. Specifying noise performance standards when purchasing equipment and modifying any used equipment through additional mufflers and engine enclosures.

b. Modifying operating mode. For example, not operating stackers on the dock would significantly reduce the possibility of exceeding WAC standards.

c. Providing screening between noise sources and sensitive receptors. The effectiveness of this measure may, however, be limited because of refraction of sound by wind and temperature gradients.

d. Restricting operations during nighttime hours.

The permits issued by the City of DuPont contain conditions designed to reduce noise impacts: (a) berms and vegetation are required to screen the village of DuPont from noise of the access road and rail spur; (b) unless specifically approved by the City of DuPont, no pile driving or other noisy construction work is allowed in the nighttime hours from 10:00 P.M. to 7:00 A.M. at the dock, within 500 feet of the Nisqually Reach, or within 1,500 feet of any residence; (c) Weyerhaeuser must take all reasonable steps requested by the City of DuPont to operate the facility in ways which minimize noise impacts on the City's existing residential area, Anderson Island, and the Nisqually Wildlife Refuge; and (d) Weyerhaeuser must plan its operations to meet the WAC standards over the full range of anticipated atmospheric conditions.

4.10 LIGHT AND GLARE

Lighting from the facility would be visible off site. The most noticeable impact would occur along the shoreline where lights on the dock and the lower portion of the roadway would be visible from Nisqually Reach and Anderson Island when loading operations continue after dark. The railroad grade and topography would shield lights on the dock access road above the railroad tracks from viewers on adjacent beaches, in the Nisqually Reach and on Anderson Island.

Lighting on the dock would be shielded to direct light onto the dock rather than permit it to flood the water surface. Lighting of the primary access route would be visible from a few houses in the Village of DuPont and from Interstate 5; however, light from most sources would not be seen from these areas due to tree interference.

Several studies including those by the UW Fisheries Research Institute (FRI) at Bangor, on Hood Canal, have shown that bright lights can attract juvenile salmon, can delay their migration, and can result in increased predation. Any migration delay could have an effect on survival.

In addition, light and glare from the wharf could be minimized by reducing lighting levels on the wharf between loading operations.

4.10.1 Light and Glare Mitigation

Weyerhaeuser has committed to the following mitigation to minimize impacts of light and glare: (a) Weyerhaeuser plans to shade all dock lights to prevent unnecessary glare on surface waters near the dock. To ensure that this measure is adequate, Department of Fisheries personnel would be asked to comment on the mitigative measure once design is complete and would inspect the final structure; (b) berms and evergreen plantings would be used to screen the village of DuPont from light and glare; and (c) Weyerhaeuser would take all reasonable steps requested by the City of DuPont to minimize light and glare on the City's existing residential area, Anderson Island, and the Nisqually Wildlife Refuge, including reduction of lighting levels of the dock and access ramp between loading operations. Levels would not be reduced below those required for security and safety.

4.11 RISK

Risks that could be created by the proposed export facility include: (1) fire or explosion (in storage areas on the terminal site); (2) accidental injury to employees; (3) Navigational hazards (wake damage, adverse effects on recreational boating, and commercial fishing); and (4) oil spills. The information in this section is based on studies by OIW, 1977, 1978, 1981).

4.11.1 Fire or Explosion

Storage of wood and paper products in the terminal area would increase the risk of fire and explosion. There would also be an additional risk of fire and/or explosion on the ships docked at the site.

4.11.2 Injury to Employees

Risk of accidents to employees in the terminal area is low, as indicated by the accident rates in other Weyerhaeuser facilities. For example, in the Tacoma sort yard, no serious accidents have occurred since 1972. The transfer of forest products to ships presents some risks to workers; however, these risks are not new and are assumed as part of a worker's job. The modern facilities provided at DuPont would probably be associated with risks lower than those for the industry as a whole.

4.11.3 Navigational Hazards

The risk of vessel casualties involving dry-cargo freighters greater than 18 feet draft would increase in southern Puget Sound. The addition of Weyerhaeuser ships to existing traffic in southern Puget Sound would introduce a potential increase of one casualty every 12 years, based on a scenario involving 53 port calls per year by DuPont-bound ships.

Weyerhaeuser anticipates that over the long-term, with the use of larger ships, port calls would decrease from an initial level of 88 to approximately 28 port calls per year. Thus, the potential increase in navigational risk specified above represents a "mid-term" operating scenario. Initially, navigational risk would be slightly greater, but over the long-term it would become less as the number of Weyerhaeuser ships calling at DuPont decreased.

Casualties, however, do not always result in oil spillage. Furthermore, freighters which carry only sufficient oil for fueling purposes, have a spill rate 15 percent of that for tank barges. Thus, the potential threat of a spill from the vessels inbound or outbound from the Weyerhaeuser facility in southern Puget Sound is much lower than that from tank barges currently operating in the area. Further discussion of risks of oil spillage is contained in Section 4.11.4.

OIW (1977) assessed three types of risks involving small vessels: (1) swamping of recreational boats; (2) collisions; and (3) damage to commercial fishing gear. The possible range of Weyerhaeuser traffic (an average 88 port calls per year initially, decreasing to 28 over the long term) would represent approximately two to six percent of the total commercial vessel traffic in 1975 in the portion of southern Puget Sound from Point Defiance south to the Nisqually Flats.

Wakes expected to be caused by Weyerhaeuser vessels (less than one foot) are the same size or smaller than those produced by pleasure craft, tugs, barges, and other large vessels (OIW, 1977). Because the increase in vessel traffic in the area would be relatively small, the project would probably add little to existing swamping hazards.

Pleasure craft in Nisqually Reach would be affected only when ships move in and out of the Reach 4 to 15 times per month depending on the number of port calls. Recreational fishing would be affected at the same frequency.

A collision between a Weyerhaeuser ship and a small boat would result in considerable damage to the small boat. Factors that affect risk of collision include weather, tides, currents, vessel traffic, faulty communications, navigation, maneuvering, and human error. Although the increased risk of collision with small boats has not been quantified, it would be small, since additional Weyerhaeuser vessel traffic would constitute only a relatively small increase in total vessel traffic in the southern Puget Sound area (OIW, 1977).

Similarly, increased risk of damage to commercial fishing gear would be low in southern Puget Sound (OIW, 1977 and 1978). Although no quantitative risk assessment has been performed, it is possible that risks of collision and damage to commercial fishing gear associated with increased vessel traffic in Nisqually Reach would be greater than in other areas of southern Puget Sound. Most existing commercial traffic uses Drayton and Balch Passages. The introduction of DuPont-bound ships would represent a greater relative increase in traffic in Nisqually Reach than elsewhere in southern Puget Sound. Damage to commercial fishing gear could occur as a result of numerous contributing factors, including weather, poor visibility, night operations, currents, tides, mechanical failure, and human error. However, according to OIW (1977 and 1978), normal precautions such as observing the rules-of-the-road and maintaining contacts with the Puget Sound Vessel Traffic Service (VTS) would minimize risks of damage to fishing gear. Furthermore, available net materials enable gillnetters to operate during the day, when better visibility lowers the risk of collision.

To minimize navigational risks, Washington State licensed pilots would board the vessels near Port Angeles and stay aboard until docking. Vessels leaving DuPont would also be piloted by a Washington State licensed pilot. Pilots are kept posted on navigational changes that occur daily and on changes listed in the Weekly Notice to Mariners. All pilots are aware of navigational aids available in Puget Sound.

Standard procedure for Puget Sound pilots is too slow down near small-boat traffic. This is done routinely in all popular fishing areas. Pilots do not consider the hazards to be encountered by ships calling at DuPont exceptional (Soriano, 1979; Skucy, 1980).

Approach to the dock would be against the current. Tugs might be used (depending on conditions and recommendations of the pilot) to dock the ship and possibly during debarking. Vessels north of Ketron Island would travel at an average speed of 12 knots; south of Ketron Island speeds would be three knots or less. Within one mile of the dock, the average speed would be one knot. Navigational procedures would not vary appreciably in fog or wind except, that severe conditions could delay docking. In such cases, the ships could anchor in the area.

Another potential hazard from increased shipping would be property damage or loss of life due to collision of a freighter with one of the ferries crossing Puget Sound or with an abutment of the Tacoma Narrows Bridge. Neither event is likely, particularly for ships equipped with sophisticated navigational aids. The increased shipping would also slightly increase the risk to residents of Anderson, Ketron, or McNeill Island who commute by private boat.

Members of the Puget Sound Pilots Association have stated that Tacoma Narrows poses no navigational threat due to its size or currents and that ship handling within the Tacoma Narrows is no problem (Soriano, 1979; Skucy, 1980).

Impacts of vessel wake on shore erosion, shore structures, and juvenile fish strandings were evaluated. These risks would be minimal for two reasons: (1) ship generated waves are smaller and have a shorter duration than wind waves; and (2) the wakes generated by the Weyerhaeuser vessels would be smaller or about the same size as the wakes produced by vessels presently operating in the vicinity (OIW, 1977).

4.11.4 Oil Spills

The proposed export facility would slightly increase the potential for oil spillage in southern Puget Sound (OIW, 1980). OIW risk calculations were based on four operating scenarios related to the most likely numbers of DuPont port calls; Scenarios I-IV assume 88, 78, 53, and 28 port calls per year, respectively. Weyerhaeuser expects fewer port calls over the long-term as ship sizes increase. Estimates of the annual oil spillage into greater and southern Puget Sound that would result from the proposed project are presented in Tables 22 and 23.

The proposed Weyerhaeuser facility would add to existing oil spill risks associated with the following:

a. freighter and traffic-related oil spills

b. product storage tanks in southern Puget Sound

TABLE 22

FREQUENCY AND PROBABILITY OF SPILL MAGNITUDES
FOR WEYERHAEUSER TRAFFIC IN SOUTHERN PUGET SOUND
(88 port calls per year)

Spill Magnitude (in barrels)	Spill Frequency and Uncertainty* (one spill every:)	Probability of One or More Spills: Percent Chance In Any Year	Probability of One or More Spills: Percent Chance In 20 Years
2.4 - 10	111 years (62-487)	0.90%	17%
10.1 - 50**	1,550 years (872-6,820)	0.06%	1.3%
A Spill ≥ 2.4	103 years	0.96%	18%
95% Confidence Limits	58-463		

*The ranges shown in parentheses for each spill size are estimates of the 95% confidence limits based on the derived historical freighter spill rate for major port systems.
**The largest recorded spill size in smaller port systems for the years 1973-1977 was 12 barrels.

Source: OIW, 1980

TABLE 23

FREQUENCY AND PROBABILITY OF SPILLS
FROM WEYERHAEUSER TRAFFIC IN SOUTHERN PUGET SOUND
(Spills ≥ 2.4 Barrels)

Number of Port Calls	Spill Frequency and Uncertainty* (one spill every:)	Probability of One or More Spills: Percent Chance In Any Year	Probability of One or More Spills: Percent Chance In 20 Years
Scenario I - 88	103 years (58-463)	0.96%	18%
Scenario II - 78	117 years (66-522)	0.85%	16%
Scenario III - 53	172 years (96-769)	0.58%	18%
Scenario IV - 28	325 years (182-1,460)	0.31%	6%

*The ranges shown in parentheses for each spill size are estimates of the 95% confidence limits based on the derived historical freighter spill rate for major port systems.

Source: OIW, 1980

c. municipal and industrial wastewater and urban runoff in southern Puget Sound

It should be noted that previous DuPont Company operations on the site involved shipment, transfer, and storage of oil (Section 1.2). No risk assessment concerning these operations is available for comparison with the risks associated with the proposed Weyerhaeuser project.

An oil spill of major proportions (100,000 gallons or more) could result from a collision between a DuPont-bound vessel and a loaded tanker or tank barge. The probability of such an event is much higher in greater Puget Sound (over 4,000 port calls per year) than in southern Puget Sound (about 75 port calls per year). Also, the normal traffic route for oil transporting barges in southern Puget Sound is through Drayton Passage (west of Anderson Island, as shown in Figure 24).

Four companies are responsible for oil-barge traffic in Puget Sound south of Tacoma. Oil barges come from Anacortes, Edmonds, and other areas in northern Puget Sound and travel on the west side of Vashon Island. North of the Tacoma Narrows, the barges share the wide shipping lanes with all the vessels of Puget Sound including those of Weyerhaeuser. Approximately six or seven barges carry bunker fuel or refined petroleum products south of Tacoma each month. Each of the barges uses Drayton Passage on its way to Shelton or Olympia.

The common route travelled by barges and Weyerhaeuser vessels is an eight mile stretch of water between the Narrows and Drayton Passage. The probability of an oil barge and a Weyerhaeuser vessel occurring in the eight mile stretch of water between the Narrows and Drayton Passage at the same time, was determined. The calculation assumed: (1) approximately seven full oil barges per month (which take one hour to cover the distance); (2) the Weyerhaeuser vessel, with Scenario I, would take 15 trips per month; and (3) a trip also takes one hour to cover the eight mile distance. The chance of both vessels occuring in the stretch is:

$$\frac{15 \text{ trips/mo.}}{720 \text{ hrs/mo.}} \times \frac{7 \text{ trips/mo.}}{720 \text{ hrs/mo.}} =$$

0.0002 or 2 trips out of 10,000 hours.

This means that once every seven months a loaded oil barge and a Weyerhaeuser vessel could be expected to travel in this eight mile stretch at the same time. The probability of a collision occurring is small and the probability of a collision resulting in major damage to the barge is much lower.

Another possible source of oil is Weyerhaeuser freighters. Most oil spills from freighters occur while the freighter is docked. The frequency and probability of an oil spill greater than 2.4 barrels caused by a Weyerhaeuser freighter would be one spill in 103 years or about one percent chance in any given year based on 88 port calls per year. The predicted spill

frequency for Scenario IV (28 port calls per year) is one spill greater than 2.4 barrels per 325 years. Spill frequencies for other scenarios are presented in Tables 23 and 24. It should be noted that the risk expression "one per 103 years" does not mean that the event would actually occur once and only once every 103 years. Such an event might not occur at all during the time period, or it might occur as early as the date of the first ship call. It means that if conditions do not vary from those used in the analysis, an event would have a .0096 probability (one percent) of occurring in any year. (An event that is certain to occur has a probability of 1.0). The amount of oil released into southern Puget Sound due to Weyerhaeuser freighter traffic would be expected to be about 0.4 barrels per year (Table 25). This compares to an existing spill rate of 0.03 barrels per year from freighter traffic in southern Puget Sound. Thus the worst case oil spill risk for freighters (88 port calls per year) would more than double the existing amount of oil released from freighters in southern Puget Sound.

It should be recognized, however, that freighters represent a very small portion of the 3,132 barrels per year, the existing oil spill risk in southern Puget Sound from all sources. Thus, doubling of the existing oil spill risk from freighters would be insignificant.

Weyerhaeuser has estimated fuel storage requirements for the upland marshalling area of approximately 607 barrels. The expected spill frequency for the proposed Weyerhaeuser product storage is one spill every 7,016 years; this translates into a 0.01 percent chance in any given year (Table 25). The estimated annual spill risk for the proposed product storage tanks is 0.04 barrels or about three percent of the existing spill risk in southern Puget Sound.

As a result of the proposed export facility, the amount of oil spillage into southern Puget Sound from urban runoff and wastewater sources would increase by three barrels per year (Tables 26 and 27). This increase in oil spill risk would be due to population increase in the area. About 200 people would be expected to relocate close to the proposed export facility.

Overall estimated annual oil spillage into southern Puget Sound from the proposed Weyerhaeuser system would be about 3.08 barrels per year, based on Scenario I, (88 port calls per year). This increase would be insignificant, representing approximately 0.1 percent of the existing risk from all sources (3,132 barrels per year) around southern Puget Sound (Table 27).

4.11.5 Oil Spill Contingency Plan

Before construction, Weyerhaeuser would submit to the City of DuPont, Coast Guard, EPA, USFWS, and Corps of Engineers an oil spill contingency plan for review describing plans for prevention, containment, and control of spills of oil and other contaminants during construction. Before operations, an operational phase spill contingency plan would be submitted to these reviewing agencies. All appropriate information would be included in these plans.

TABLE 24

COMPARISON OF FREIGHTER OIL SPILLAGE RISK IN SOUTHERN PUGET SOUND

Scenario	Number of Port Calls	Existing Risk (Barrels per year)	Weyerhaeuser Incremental Risk (Barrels per year)	Total (Barrels per year)
I	88	0.03	0.04	0.07
II	78	0.03	0.03	0.06
III	53	0.03	0.02	0.05
IV	28	0.03	0.01	0.04

Source: OIW, 1980

TABLE 25

FREQUENCY AND PROBABLILITY OF SPILLS FROM
THE WEYERHAEUSER PRODUCT STORAGE TANK FACILITIES
(Spill = 2.4 Barrels)

Storage Volume *(in barrels)*	Spill Frequency and Uncertainty* *(one spill every:)*	Probability of One or More Spills	
		Percent Chance In Any Year	Percent Chance In 20 Years
607**	7,016 years (5,444-9,865)	0.01%	0.28%

*The ranges shown in parentheses are estimates of the 95% confidence limits based on the derived historical product storage tank spill rate.
**Volume provided by Weyerhaeuser (1980).

Source: OIW, 1980

TABLE 26

ESTIMATED ANNUAL OIL SPILLAGE IN
GREATER PUGET SOUND FROM THE PROPOSED WEYERHAEUSER SYSTEM

Source of Oil Input	Estimated Oil Spillage (Barrels Per Year) Scenarios I through IV
Freighters	0
Storage Tanks	0.04
Urban Runoff and Wastewater	3
All Sources	3.04

Source: OIW, 1980

TABLE 27

ESTIMATED ANNUAL OIL SPILLAGE IN
SOUTHERN PUGET SOUND FROM THE PROPOSED WEYERHAEUSER SYSTEM

Source of Oil Input	Estimated Oil Spillage (Barrels Per Year) Scenario I (88 port calls/year)	Scenario IV (28 port calls/year)
Freighters	0.04	0.01
Storage Tanks	0.04	0.04
Urban Runoff and Wastewater	3	3
All sources	3.08	3.05

Source: OIW, 1980

The contingency plan would provide the framework for an emergency response effort in the event of spills at or near the DuPont dock. The plan would provide procedures for mobilizing additional resources if the spill exceeded levels controllable by Weyerhaeuser personnel. Elements to be included in such a plan have been summarized by the Washington State Department of Ecology (WDE, 1977). Those applicable to this facility include:

a. A map showing drains and drainage paths taken by spilled material

b. A list of petroleum products, their volumes and method of storage (barrels, above ground tanks, etc.,) and other hazardous materials used in the ships or at the dock

c. Description of containment devices, especially the proposed holding and treatment system located under the dock

d. A company spill reporting and mobilization procedure, including telephone numbers of applicable federal and state agencies

e. A clean-up methodology, list of equipment and its location and appropriate use

f. A list and schedule of required inspections of spill control devices and practices

g. Appropriate record keeping to assure the above

h. Security provisions if needed to protect the integrity of the spill prevention system.

Appendix M provides more detail regarding the purpose and contents of the oil spill contingency plan.

4.11.6 Risk Mitigation

Plans for control and clean-up of any spills of oil or environmentally hazardous materials in connection with construction and operation of the facility, including equipment and training of personnel, would be approved by the City of DuPont prior to construction for the construction spill plan and prior to first shipment for the operations spill plan. Plans would be submitted for review to the City of DuPont, Coast Guard, EPA, USFWS, and the Corps of Engineers.

4.12 POPULATION AND EMPLOYMENT

4.12.1 Operational Impacts

When the proposed export facility reaches the design volume of two million tons per year, 130 to 165 permanent employees would be required to operate the facility. Not all of the 130 to 165 jobs on the site would represent new positions. Approximately 38 of these employees would be transferred from Weyerhaeuser operations at the Port of Tacoma. Furthermore, the greater efficiency of the DuPont Export Facility would initially eliminate about 36 to 45 longshoring job equivalents in Tacoma, Longview, and Everett. The displaced workers would be reallocated to other jobs by their ILWU Union rather than laid off. Thus, the proposed export facility would provide 47 to 91 new jobs in the Puget Sound region. In the long term, according to Weyerhaeuser, the DuPont facility offers overall company growth which would lead to a total increase in longshoring work required by the company in Washington State.

The increased number of jobs would not be significant for the region; however, for the City of DuPont and the nearby town of Steilacoom, the direct increases in local employment would be relatively significant. Local employment that was lost when the DuPont Company discontinued its manufacturing operations would be replaced, reducing the dependence of the local economy on adjacent military bases. Although few of the facility employees would be expected to reside in DuPont, the export operations would generate increased employment opportunity for local residents seeking jobs as guards or in support industries (e.g., store clerks, gas-station attendants, etc.)

Population changes from operation of the proposed facility would be expected to be neglible from a regional perspective. Local changes would also be small. The 47 to 91 new jobs would be expected to be filled mainly by persons presently living in the region. As many as 65 households (200 persons) could relocate closer to the facility within five to ten years. This growth is small compared to the growth expected in the local area in the same period.

Operation of the facility would have only minor effects on the greater Puget Sound regional economy. Two-million tons of forest products would pass through DuPont each year, rather than through other ports, decreasing slightly the earnings of longshoremen and shipping related services in northern Pierce County and Cowlitz County. Longshoremen would be diverted from other Weyerhaeuser facilities. To the extent that the facility allows Weyerhaeuser to

expand or maintain its export volumes, it would contribute to employment in continuing and potentially added production operations in those areas, offsetting the impact of redistributing the shipping-related jobs.

The increased net employment and international trade development resulting from the project is consistent with the Alternatives for Washington policies (Washington Office of Program Planning and Fiscal Management, 1976).

4.12.2 Construction Impacts

Construction of the proposed export facility is expected to take approximately two years. Peak employment is estimated at 300 construction workers. Large projects like the proposed facility are typically contracted to regional construction firms that fill their labor requirements largely from existing employment rosters. Thus, the major effect of proposed construction activity would be support of the southeastern Puget Sound region's existing construction labor force.

During construction of the facilities, the income of Pierce and Thurston counties would be boosted by 10 to 18 million dollars a year. This amount represents a seven to 13 percent increase in the total available personal income for employees in the construction trades. In addition, purchases of materials and equipment would beneficially affect Puget Sound suppliers. The quantity required, however, is not large enough to significantly affect production requirements.

For a more extensive discussion of population and the local economy, refer to the DuPont Export Facility Socio-Economic Impact Study (URS, 1978) prepared for this Environmental Impact Statement.

4.13 HOUSING

Operational and construction jobs are expected to be filled almost entirely by persons presently residing in the region. As a result, little net migration into the region would result from the project. Over time, some workers would probably move closer to DuPont.

No more than 10 percent of the peak-period construction workers' households (30 families) would be expected to relocate as a result of the project since (1) a high percentage of this available construction work force already resides within commuting range of the project site, (2) on-site employment prospects are short term, (3) housing availability in the immediate DuPont-Steilacoom area is presently negligible, and (4) a willingness to commute to job sites is characteristic of construction labor in general.

As many as 50 percent of the permanent employees (approximately 65 families) could relocate closer to DuPont over a five to ten-year period after operations begin. Although DuPont can provide only limited additional housing, housing construction in the surrounding area should be sufficient to readily accommodate project-related demand for approximately 100 units in a ten-year period.

4.14 TRANSPORTATION/CIRCULATION

4.14.1 Construction Traffic

Access to the site during the 24 to 30-month construction period would be provided by secondary roadways connecting the terminal site to the DuPont-Steilacoom road. Access for construction of the overpass at the Mounts Road Interchange would be provided by roads parallel to Interstate 5 (see Figure 6). All vehicular traffic generated by construction activity would be confined to these routes.

The addition of approximately 500 to 700 construction-related vehicles per day would increase congestion on the DuPont-Steilacoom road; however it would not significantly affect the overall operating characteristics of the roadway.

The access roads would be inspected regularly and repaired as needed throughout the construction period to ensure they remain in good condition. Pavement markings, which suffer particularly high wear during heavy truck usage, would be similarly maintained.

The arrival and departure of trucks hauling material to the site could create traffic disruptions because of their size and low rate of acceleration. This impact would be largely mitigated if truck deliveries could be scheduled to avoid peak traffic; however, independent suppliers who would be making deliveries are not under Weyerhaeuser control. The company has committed to work with the City of DuPont on traffic control measures if construction traffic were to become a significant problem.

Northbound left turns from the DuPont-Steilacoom road to the site would not be difficult because of the relatively low opposing traffic volume, which should allow frequent gaps in the traffic stream. Traffic control devices at the intersection of the access road and DuPont-Steilacoom Road would be unnecessary. This intersection would, however, have proper illumination for safety. Lighting levels of two to three-foot candles would suffice.

DuPont-Steilacoom Road and Barksdale Avenue intersect near Interstate-5. Southbound traffic on DuPont-Steilacoom Road, though heavier than Barksdale traffic by a ratio of 2.8 to 1, is presently controlled by a stop sign at the intersection. The additional traffic and consequent congestion on the DuPont-Steilacoom Road generated during the construction phase of the project would increase this imbalance.

Construction traffic would have minimal adverse impact on Interstate 5 and the system of state highways serving the site. The 500 to 700 trips per day generated by construction would be negligible in comparison to the present traffic volume of 53,800 vehicles per day on Interstate 5 in the DuPont vicinity. During construction most of the additional traffic would use the DuPont interchange. Construction activities at the Mounts Road interchange would affect traffic using that interchange.

4.14.2 Operational Traffic

Primary vehicular access to the facility would be provided by a modified connection from Interstate 5 to the site (Figures 6 and 8).

The Mounts Road interchange would be significantly improved to handle the increased traffic loads (Figure 8). A 78-page traffic study, "DuPont Site Development Access Road - Engineering Design Report" prepared in March 1978 and reviewed April 1981 has already been completed for the proposed access road. The study, available for review at the DuPont City Hall, investigated present and projected traffic volumes, the existing overpass, ramps, and the addition of signalization.

The Washington State Transportation Department is reviewing plans to assure that modifications meet its requirements and approval. The planned modifications include:

a. Traffic-actuated controls and a signal with some back-up signing for the north intersection

b. Relocating the existing off-ramp from northbound Interstate-5 at the south intersection to provide additional sight distance. The modification would provide additional distance for the stacking of vehicles crossing the overpass prior to turning left onto the new frontage road. The modification would include providing an additional lane in the existing on-ramp for vehicles to turn right from the new Weyerhaeuser frontage road

c. The Mounts Road intersection, with the addition of traffic signals and signing modifications, would allow traffic to move all of the various destinations with minimal restrictions.

This new roadway leading to the site would have an alignment, profile, and geometric design suitable for handling the traffic loads that would be generated during peak activity at the site. This new access road would eliminate the need to use Barksdale Avenue (DuPont's main street) as the primary access route.

Secondary access to the site from Steilacoom and Lakewood would be provided by the roadway leading from the site to the DuPont-Steilacoom Road. Presently, there is congestion on the Fort Lewis and DuPont exits and entrances adjacent to Interstate-5 during the morning and afternoon worker commuting times. The proposed truck traffic would not use these interchanges but the improved Mounts Road Interchange. Because the number of operational workers would remain the same as when DuPont Company operated on the site, traffic quantities would not change. There would be an increase in traffic, but the increase would not significantly impact the overall operating characteristics of the roadway.

The practical service volume that can be adequately carried by the new access roadway under ideal conditions would be about 450 vehicles per hour (both directions), assuming speeds of 30 to 40 miles per hour and

few passing maneuvers. The peak traffic rate of 164 vehicles per hour on the access road would occur during shift-break (assuming two or more shifts, as anticipated). The new roadway would be operating well within its practical capacity with the estimated maximum volume representing approximately 36 percent of the service volume that could be carried.

All of the traffic generated by the facility would arrive and depart via Interstate 5. The new Mounts Road interchange would be used by all trucks, while the DuPont interchange would be used by many employees. Even using worst-case assumptions, traffic attributable to the Weyerhaeuser facility (164 vehicles) would constitute only three percent of all traffic on Interstate 5 near the Mounts Road interchange; therefore, the impact of the proposed facility on the freeway can be assumed to be negligible. Little, if any, increase in traffic through Steilacoom or DuPont would be expected.

Similarly very little change in traffic, if any, would occur on SR 510. Existing log movement from the Yelm area is primarily by rail. In any case, logs would be expected to be a declining proportion of product mix at DuPont as markets for manufactured products develop.

4.14.3 Railroad Transportation

The proposed railroad access to the site is via a spur line connection to the Burlington Northern track that runs along the north side of Interstate 5 (Figure 6). Rail deliveries to the facility are expected to average 120 to 165 railroad cars per day. Three to eight trains would be required.

The existing rail line running through the Village of DuPont, which serviced the DuPont Company, would not be used for the proposed export facility.

The line leading from Tacoma directly to the site is restricted in tonnage capacity due to the grade south of Tacoma, which is 2.2 percent. The line leading to the site from the south has a more favorable grade and can accommodate greater tonnages than the line from the north. The existing line can accommodate deliveries to the site from both directions; however, additional switching facilities would be needed to accommodate the expected volume of rail traffic.

The increased railroad traffic to the site would delay traffic at crossings. The impact cannot be fully assessed, however, until final train routing has been determined. To minimize impacts, rail traffic on the northbound line, which crosses DuPont-Steilacoom Road and other roadways to the north, could be scheduled to avoid peak traffic hours. (Such scheduling is determined by Burlington Northern Railroad.)

4.14.4 Marine Transportation

The facility would generate in the range of 28 to 88 calls per year. This number does not represent additional ships in Puget Sound, but rather a redistribution of them. In fact, at full operation there would be a reduction in the total number of ships used because they would be larger with additional

carrying capacity. Instead of going to existing ports for the same product volume, the ships would go to DuPont. At project start-up, Weyerhaeuser anticipates 88 port calls per year. Over the short-term and mid-term, port-calls would number 78 and 53 port-calls per year, respectively. Eventually, with the use of large ships port-calls would be reduced to 28 per year. Vessel traffic on Puget Sound is controlled by the U.S. Coast Guard Vessel Traffic Control System, which provides radar surveillance and vessel tracking throughout northern and central Puget Sound but not south of the Tacoma Narrows. The system is capable of monitoring and managing a large number of vessels; therefore, rerouting 7-8 vessels per month would not adversely impact the system. For a discussion of navigational risks, see the section on Risks.

4.14.5 Transportation/Circulation Mitigating Measures

Of the mitigating measures identified above, Weyerhaeuser has committed to the following mitigation to minimize impacts to transportation/circulation: (a) the access road used during construction would be inspected regularly and repaired as needed; (b) traffic routing patterns and expected traffic loads for both trucks and construction worker vehicles would be submitted for review and approval by the City of DuPont; (c) Weyerhaeuser would reimburse the City for any costs reasonably incurred for control of construction traffic along the DuPont/Steilacoom Road, and any other public roads used within the City of DuPont; and (d) unless specifically approved, no heavy trucks or construction traffic would use Barksdale Avenue, Louviers Avenue, Brandywine Avenue, or DuPont Avenue.

4.15 PUBLIC SERVICES

Operation of the export facility would require no significant expansion of existing public services and facilities. Police and fire departments in the City of DuPont are presently adequate to provide the protection services required during operation of the proposed export facility.

As discussed under Risks, fire hazards on the site, particularly in the terminal area, would increase. If a fire does occur at the export facility, the DuPont Fire Department will respond first. Two Weyerhaeuser helicopters would be available to assist the department. Because the major expertise of the DuPont Fire Department is fighting building fires, it would probably need assistance from the Fort Lewis Fire Department and the Washington State Department of Natural Resources to control a major log-storage fire. Because one portion of the Weyerhaeuser site is accessible only by boat or railroad, the city intends to sign an agreement with the University Place Fire Department, giving DuPont use of the University Place fireboat in the event of a fire at that location.

Depending on the number of increased emergency calls, DuPont may benefit by the purchase of an aid vehicle. A portion of the surplus revenues generated while the facility is under construction could be reserved for such purchase should it prove necessary.

Weyerhaeuser would take all necessary precautions to minimize the possibility to fires in its log and forest-product-storage areas. It would follow the National Fire Protection Association's guidelines (NFPA 46 and 46B). In addition, it would clear a fire break around the perimeter of the project. Weyerhaeuser plans to maintain cattle on the property to keep the brush from the grasslands down and reduce fire hazards.

Facility employees and their families are expected to live primarily in northeastern Thurston County, the Lacey area, northwestern Pierce County, and the Lakewood area. Local fire, police, and sheriff departments in these areas are adequate to protect the small additional population.

Children of the new Weyerhaeuser employees residing in northeastern Thurston County (where about 30 employees would be expected to relocate) would face overcrowded school conditions unless supporting school bonds are approved by the voters in that region. If bonds are not approved, the additional crowding would be a minor indirect adverse impact of the project.

Local hospital facilities have adequate capacity to serve the employees and their families.

The proposed project would have little effect on regional parks and recreational facilities and only minor effects on local park and recreational facilities. The 65 families expected to relocate would put a small additional strain on the already crowded neighborhood and community parks (parks under 25 acres).

Potential impacts on the Nisqually Delta National Wildlife Refuge are discussed in Sections 4.3.2, 4.5.4, 4.6, 4.8, 4.9, and 4.11. No recreational impacts would be expected in the area due to normal operation of the proposed facility. In the event of a major oil spill, recreational resources in the impacted area would be degraded. The project would have no impact on public access to the Nisqually Wildlife Refuge.

Because only limited areas within the Village of DuPont are available for future residential development, the number of new residents would not be large enough to adversely affect the existing recreational resources. Nonetheless, tours or other public attractions that Weyerhaeuser might propose could affect DuPont's recreational resources. Tourists could overtax the limited parks available in DuPont. Similarly, the tiny DuPont museum can accommodate only a few tourists at one time.

4.15.1 Public Services Mitigating Measures

Weyerhaeuser has committed to the following mitigation to reduce impacts on public services: (a) Weyerhaeuser plans to maintain cattle on the property

to keep the brush from the grasslands down and reduce fire hazards; and (b) Weyerhaeuser shall cooperate with the City of DuPont in development of plans for public recreation as part of the City's comprehensive planning process. Until completion and implementation of such a public recreation plan by the City (see Section 3.2.2), Weyerhaeuser will allow public recreational use of (1) its tidelands, and (2) the longhsoremen's trail to the beach (including the tunnel under the BN railroad tracks), the parking area associated with it, and the access road to the parking area.

4.16 UTILITIES AND ENERGY

4.16.1 Construction Impacts

Public utilities would be minimally affected by construction of the proposed facility. Fossil fuels would be consumed by construction equipment.

Water supplies would be needed during construction for dust control and domestic use. During the dry summer months, dust abatement would require about 45,300 gallons of water per day. Water demand for direct consumption by workers would be small and would probably be met by water carried onto the site by the construction firm or by the workers themselves. Sanitary wastes would probably be handled by temporary toilets requiring no water. Solid waste production during construction would be small and any wastes would probably be taken to the Fort Lewis landfill site next to the construction site.

The primary use of energy during construction would be fuel consumption by construction equipment. Assuming that construction requires five heavy vehicles operating eight hours per day, five days per week and that these vehicles use seven gallons per hour, construction use would average 72,800 gallons of fuel per year over the 2 to 2-1/2 year construction period.

Site illumination and other electrical use would consume 400 megawatt hours per year. The additional consumption of power and fuel would have relatively little effect on existing regional energy-use patterns.

4.16.2 Operational Impacts

Water would be needed for fire protection, domestic consumption, log sprinkling, and irrigation of landscaping. The National Fire Protection Association (NFPA) guidelines recommend a fire-protection water supply with a minimum delivery capability of 1,000 gallons per minute.

Water use by industrial employees averages about 40 gallons per day (gpd) per person. During dry periods in the summer, up to 300,000 gpd would be required. Existing wells and reservoirs on the south side of Sequalitchew Creek have the capacity to adequately meet both these water needs. Recycling of log-sprinkling water would decrease water withdrawal rates. High nitrate levels in the wells near the DuPont Company headquarters may be a problem for drinking water. Bottled water is now used on the site. According to Weyerhaeuser Company nitrate levels have been declining.

Operations at the facility would generate a wastewater (sewage) flow approximately equal to domestic water use. This waste would be disposed of through an on-site septic-tank and drainfield system. Storm runoff from the terminal area would be adequately handled by the proposed on-site stormwater system and would not affect city or county facilities. Oily wastes from vehicle-maintenance areas would be recycled, avoiding water contamination.

Only minimal amounts of solid waste would need to be disposed of locally because bark and other log-handling wastes would be used at other Weyerhaeuser facilities. Any solid waste produced would be transferred to the Fort Lewis landfill site, which has a life expectancy of another 15 years.

Operations at the facility would consume both electrical energy and fuel oil. Electrical power to the site would be delivered under a noninterruptable agreement and is estimated to total 6.2-to 8.3-million kilowatt hours per year (compared to approximately 23,800 kilowatt hours per single family residence with electric heat). Of this amount, 63 percent would be used by the debarker and 16 percent by site illumination. This demand can be readily met by local power utilities. The DuPont Company, previously on the site, used 8.1 million kilowatt hours per year. Energy use could be reduced by lighting only those portions of the primary access route required for safety.

No alternative energy sources are currently considered practical for lighting. However, electricity used for lighting would be minimized by reliance on fluorescent lighting.

Solar heating, heat pumps, and various thermal energy storage systems are available to minimize electrical use for space heating and the limited amounts of hot water needed for restroom facilities. Non-electrical heating alternatives include natural gas, oil, coal and burning of wood wastes. These alternatives would be studied as part of the final facility design, and would be reviewed periodically thereafter. Weyerhaeuser expects to utilize the most economical heat sources, consistent with applicable regulations and the company's policy of being self-sufficient in energy and not dependent on oil for major stationary facilities where practical.

The debarker probably could be operated with natural gas, diesel, heavier oil or wood waste as a power source, either through conversion to electricity or through direct steam power. Again, the alternatives would be studied as part of the final facility design, and reviewed periodically. However, Weyerhaeuser has found purchased electricity to be the most appropriate power source for its current log debarking operations at the Port of Tacoma, which would be replaced by the debarker at DuPont. Relocation of the debarker would not produce a net increase in local electrical demand, and not likely to change the most economical means of powering a debarker.

Weyerhaeuser expects to ship the bark and wood waste produced at the facility to its other locations for production of steam and electricity in its existing boilers. Burning this material at DuPont thus would reduce the energy supply to Weyerhaeuser's existing facilities. Although on-site burning of wood wastes might become economically and environmentally

desirable at some future time, it does not currently appear feasible in light of the relatively small energy consumption of the facility as compared to the fairly large capacity of typical wood waste boilers under current technology. Any onsite burning of wood waste would generate air pollutants such as particulates and would be subject to all applicable environmental laws, particularly those relating to air pollution. This would require obtaining additional regulatory permits.

The export facility is expected to utilize gasoline or diesel for materials handling equipment. Although it is technologically feasible to utilize other power sources, petroleum fuels are expected to remain the most economical and source of power for mobile equipment for the foreseeable future.

When the facility is operating at peak capacity, annual fuel consumption by equipment at the site would total 500,000 to 600,000 gallons of diesel, 80,000 to 100,000 gallons of propane, and 4,000 to 5,000 gallons of gasoline. In addition, trains and trucks delivering the logs and other forest products would consume petroleum. As discussed in the DuPont Export Facility Socio-Economic Impact Study, one can estimate that trains would consume approximately 400,000 gallons of fuel per year and that trucks would use about 860,000 gallons of fuel per year. The fuel consumption does not represent net increased use but rather a shift in location of usage.

The Washington State Energy office administers a fuel allocation program designed to equitably distribute fuel throughout the State in times of fuel shortages. Diesel fuel is currently in plentiful supply and this situation would continue into the foreseeable future (Ackerstrom, personal communication). The additional demand of 40,000 gallons/month of diesel resulting from the new facility should not significantly affect supplies in the Greater Tacoma area. The gasoline situation is somewhat tighter although supplies are currently adequate. Gasoline demand due to facility operation and worker commuting would be on the order of 5,000 gallons/month. This may be a significant enough increase for local retail outlet to request and be granted an increase in their base[1] monthly gasoline allocations (Ackerstrom, 1977, personal communications).

4.17 GOVERNMENTAL FINANCE

As described above, marginal increases in employment, housing, and population activities and their indirect effect on public services would be dispersed throughout southwestern Pierce County and northeastern Thurston County. Therefore, relative to existing activity levels and the current capacities of public services in these jurisdictions, the increased costs due to the export facility would be minor, whereas increased revenues would be substantial. Although the following revenue and cost figures were developed in 1978, the magnitude of the potential revenue impacts are still useful in determining the range of fiscal related impacts.

4.17.1 Revenues

When the proposed facility is fully operational, substantial tax revenues would be generated. Increases in assessed value are expected to occur over a six-year period. Once the facility is completed, the assessed valuation of property in the City of DuPont is expected to be approximately $57.5 million. The resulting increases in tax revenues are shown in Table 28, which contrasts revenues with and without the project and shows which taxing authorities would benefit.

TABLE 28

PROPERTY TAXES GENERATED IN DUPONT[a]

	Tax Revenues	
Taxing Authority	With Project	Without Project
City of DuPont	$ 38,859	$ 9,050
Pierce County	76,728	17,871
State of Washington	231,337	50,334
Port of Tacoma	18,511	4,311
Special School Levies	57,514[b]	12,514[b]
Total	$422,949	$94,080

[a]These projections were developed in the DuPont Export Facility Socio-economic Impact Study (URS, 1978).

[b]Amount raised by a levy increment of $1 per $1,000 of assessed valuation.

The purchase of supplies and services during operation would result in annual Business and Occupation use, and sales tax revenues to the state ($20,000/year) and to the City of DuPont ($3,000/year). Stevedoring services will provide additional revenues of $6,300 to the City of DuPont and $13,300 to Washington State.

In addition, Weyerhaeuser has been paying the City of DuPont $48,000 per year to defray the costs of increased fire and police protection and miscellaneous administrative costs. This voluntary payment is expected to continue until the revenues associated with the project exceed the local costs.

Construction of the proposed facility would also generate significant revenues for the state and the City of DuPont. Assuming that 80 to 85 percent of the projected design engineering and construction expenditures would be subject to the state and city Business and Occupation Tax, the state would receive an estimated $230,000 and the city an estimated $215,000 during the 2 to 2-1/2 year construction period.

State and local sales tax revenues from the 80 to 85 percent of construction expenditures assumed to be subject to these taxes would total about $1.8 to $2.0 million over a four-year period. Of this amount, the state would receive about $1.7 million and the City of DuPont $180,000 to $200,000.

4.17.2 Costs

Services required by the proposed project would increase costs for both the City of DuPont and Pierce County. The costs to both jurisdictions is not great because Weyerhaeuser Company would construct its own access roads and provide its own security system. Increased costs to the city would be related to streets, roads, and fire protection. Road maintenance would be the major increased cost to Pierce County.

The City of DuPont may need to improve the existing intersection of Barksdale Avenue and DuPont Steilacoom Road; however, low capital cost improvements, such as increased police supervision or right-of-way or lane realignments would probably suffice.

The city's fire department has upgraded its capability by training crews in the special techniques required for adequate fire prevention and fighting in the City of DuPont. The department hired a full-time chief in August, 1977.

The construction and operation of the export facility would increase DuPont's annual costs no more than 10 percent for additional judicial activities, planning, general administration, and similar services. Because only limited residential property is available, few employees would be able to locate in the DuPont area, thus avoiding the need for additional support facilities and utilities.

Another small cost to Pierce and Thurston Counties would result from relocation of workers and their families to the area near DuPont. Additional students would indirectly result from the construction and operation of the export facility. Presence of these students would not require any further capital investment by the school district nor would their absence alleviate current investment requirements. Operating expenses would increase slightly, however.

4.17.3 Cost/Benefit Analysis

The City of DuPont would benefit significantly from the revenues (primarily property tax) resulting from the presence of the export facility. The benefit to the city exceeds costs because (1) Weyerhaeuser Company would provide almost all of the new required facilities and infrastructure, (2) no residential growth in DuPont would be associated with the project. Both these factors would reduce costs that might otherwise be incurred.

Any change in these two factors could significantly change the city's fiscal balance. In contrast, if the construction period must be lengthened or shortened, no changes in revenues would result. Revenues are expected to exceed costs about two years after construction start-up. The present negative fiscal impact to the city is being offset by the voluntary payment by Weyerhaeuser of $48,000 per year for increased fire and police protection.

In Pierce and Thurston Counties, all increases in government support required by the export facility (except education) would be within the existing capacities of Pierce and Thurston counties' service infrastructure. Therefore, no major increases over current budgets would be needed. Increased revenues to Pierce County from property taxes on the proposed facility would exceed costs.

Weyerhaeuser Company presently owns its docks and loading facilities within other port jurisdictions. Only Weyerhaeuser cargo is shipped over the company's docks. When cargo of other shippers is accepted aboard Weyerhaeuser chartered vessels, it is loaded at public docks. The DuPont project would not affect this arrangement. No revenue accrues to public ports from the company's shipments over its private docks, wherever they are located. Therefore, the DuPont facility and its private dock would not take business or revenue away from any public ports.

4.17.4 Governmental Finance Mitigating Measures

Weyerhaeuser has committed to the following mitigating measure to reduce impacts on governmental finance: Weyerhaeuser would continue to pay the City of DuPont $48,000 per year to defray the costs of increased fire and police protection and miscellaneous administrative costs until such time that the revenues associated with the project exceed the local costs.

4.18 HUMAN HEALTH

The impact of induced growth on area medical facilities is discussed above under Public Services.

Both construction and operation of the proposed facility would involve some risk of accidental injury. Medical facilities in the vicinity are adequate to handle these injuries. Operational hazards in the terminal area may be comparable to those in Weyerhaeuser's Tacoma sort yard, where no time has been lost because of accidents in the last eight years.

4.19 AESTHETICS

Construction of the proposed export facility would have both on-site and off-site aesthetic impacts. An aerial view of the proposed facility is shown in Figure 51.

Off-site impacts are more important to the public because the site itself is not open to the public. The most significant off-site impacts would be the change in the shoreline view from Anderson Island and Nisqually Reach, portions of the Nisqually Delta, and Interstate-5. The 1,300-foot

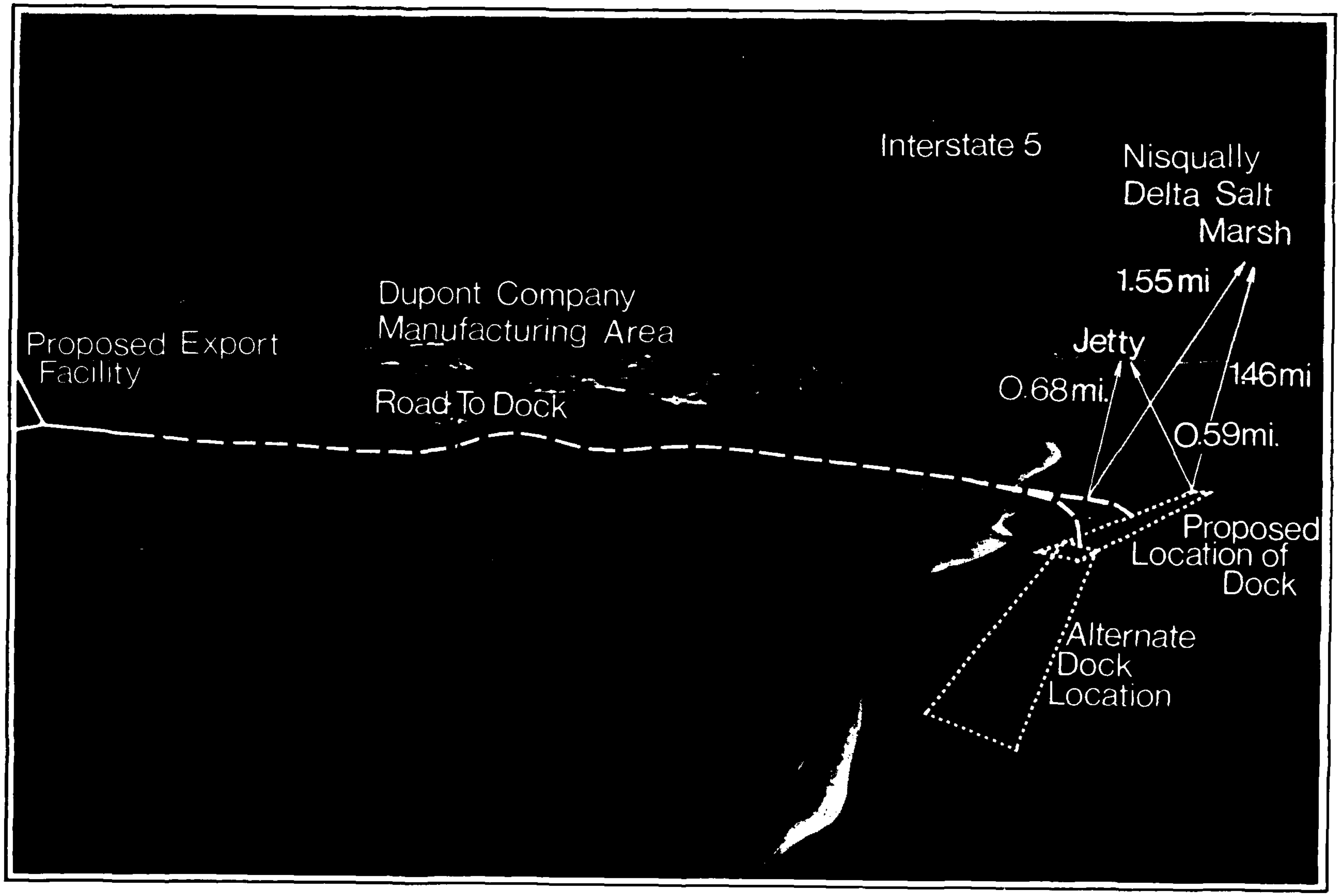


FIGURE 51
AERIAL VIEW OF PROPOSED
EXPORT FACILITY AREA

dock and the lower portion of the road down Sequalitchew Creek Canyon would be visible from the Reach and portions of Anderson Island. In addition, the existing pier would be removed. The dock and ships loading at the facility would be visible from parts of the Delta and from Interstate-5 southwest of the Delta.

Other off-site impacts would be minimal. The terminal facilities on the upland portion of the site would be visible from only a short segment of DuPont-Steilacoom Road and the adjoining portion of north Fort Lewis. Evergreen forest provides a visual buffer in all other directions.

On-site impacts would be limited to the Sequalitchew Creek ravine, the terminal site, and the access route. Construction of a 57-foot wide reinforced-earth road with a retaining wall 30-feet high in some areas would substantially alter the aesthetic character of the canyon (Figure 42). The terminal site and most of the access route would be located in prairie areas with much less aesthetic value than the creek or the shoreline (Figure 44).

The bluff scenic easement in the MOU negotiated between Weyerhaeuser and FWS would ensure that the forest along the bluff owned by Weyerhaeuser would not be clearcut (Section 3.2). The view of the bluff from the shoreline, Nisqually Reach and Anderson Island would, therefore, be unaltered.

Maintaining buffers and distance from public roads and residences whenever possible would keep the proposed terminal out of sight for most people.

4.19.1 Aesthetic Mitigation

Weyerhaeuser has committed to the following mitigating measures to reduce impacts on aesthetics: (a) the access road and rail spur would be further screened from view from the village by planting evergreen trees, and constructing berms and fences (plans for such screening would be submitted to the City of DuPont for approval); and (b) maintaining buffers and distance from public roads and residences whenever possible would keep the proposed terminal out of sight for most people.

4.20 CULTURAL RESOURCES

No known cultural resource sites listed or eligible for inclusion on the National Register of Historic Places would be affected by the proposed project as currently conceived. Consequently, a program of action to mitigate specific project related impacts to sites of National Register significance is not called for at this time. It is recognized, however, that possibly significant cultural resources could still exist, unrecognized, in the project area despite the reconnaissance work already accomplished. Therefore, certain precautionary actions, including selective auger testing and monitoring, would be undertaken prior to and during construction. These actions would serve to preclude or greatly minimize the potential for damage to sites or

loss of information at known, suspected, and presently unknown cultural properties. Notification of the discovery of all potentially significant cultural resources would be made promptly to the State Historic Preservation Officer (SHPO). Consultations with the SHPO and other appropriate agencies or groups would be held as situations warrant.

The 25 archaeological and historical sites identified during the field reconnaissance are listed in Table 29 and show the potential for adverse project impact. As noted above, none of the sites with high or low potential for adverse project impact is listed or eligible for inclusion on the National Register of Historic Places.

4.20.1 Measures to Prevent Damage to Presently Unknown Significant Cultural Resources

Weyerhaeuser has committed to the following measures to prevent damage to presently unknown significant cultural resources: (a) all contracts for construction work that could disturb any known or potential sites would contain clauses requiring the contractor to participate in briefing and training sessions with the SHPO and to immediately stop work and notify the SHPO and Weyerhaeuser if any archaeological artifacts are discovered, and to suspend all work in the area of such artifacts until completion of consultation with the SHPO; (b) all such contractors would be briefed before commencement of work on the location of nearby sites or suspected sites; (c) the SHPO and the Nisqually Indian Tribe would be invited to participate in these briefings. If any significant sites are discovered, Weyerhaeuser would consult with SHPO and the Nisqually Indian Tribe about the most appropriate measures to record, preserve, and/or mitigate potential damage to such sites; (d) where practical, the project would be redesigned or relocated to avoid disturbance to any sites; (e) auger tests on the north side of Sequalitchew Creek where excavation would occur near potential burial sites would minimize risks to any presently undiscovered archaeological resources; (f) on the recommendation of the former deputy SHPO, Jeanne Welch, test pits (2 m x 2 m) would be excavated at the railroad dump sites and any artificial material recovered would be carefully analyzed and compared with historical data that relates to that period of industrialization; (g) if the presumed location of the Richmond Mission is found to be within the final bounds of the project, testing will be undertaken.

TABLE 29

ARCHAEOLOGICAL AND HISTORICAL SITES - POTENTIAL IMPACTS

	Site Designation	Site Name	Location			Potential For Adverse Project Impact			Remarks
			Known	Unconfirmed	Unknown	High	Low	None	
1.	45-PI-54	Sequalitchew Site (and Nisqually House)	X	(X)				X (X)	The Sequalitchew Site was listed on the National Register of Historic Places 10-16-74. The 1832 Nisqually House may have been associated with this site but no remains have ever been found.
2.	45-PI-55	1833 Fort Nisqually	X					X	The 1833 Fort Nisqually was listed on the National Register of Historic Places 2-14-79.
3.	45-PI-56	1843 Fort Nisqually	X				X	X	Known location of fort will not be affected. Testing by auger of proposed access corridor west of site will be undertaken to determine presence or absence of unknown outbuildings associated with fort as recommended by Deputy State Historic Preservation Officer.
4.	45-PI-57	Men's Boarding House		X				X	
5.	45-PI-58	Brick Yard Dump	X					X	
6.	45-PI-59	Old Town Dump	X					X	
7.	45-PI-60	Edmond Marsh Dump	X					X	
8.	45-PI-61	Railroad Dump #1	X			X			One test pit (1 x 2 meters) will be excavated to acquire sample of materials and information to complete site record -- action recommended by Deputy State Historic Preservation Officer.
9.	45-PI-62	Railroad Dump #2	X			X			One test pit (1 x 2 meters) will be excavated to acquire sample of materials and information to complete site record -- action recommended by Deputy State Historic Preservation Officer.
10.	45-PI-63	Railroad Dump #3	X			X			Site does not warrant further investigation.
11.	45-PI-64	Burning Ground Dump	X			X			Site does not warrant further investigation.
12.	45-PI-65	DuPont Town Dump	X					X	
13.	45-PI-66	Richmond Mission		X			X	X	Location in which site is reported to be will be tested if it is found to fall within bounds of proposed upland development.
14.	45-PI-67	Wilkes Observatory		X				X	
15.	45-PI-68	Farm Locality	X					X	
16.	45-PI-69	Town of DuPont	X					X	
17.	45-PI-70	DuPont Company	X					X	
18.	45-PI-71	Sawmill			X			X	
19.	45-PI-72	DuPont SW	X					X	
20.	45-PI-73	Indian Hall			X			X	
21.	45-PI-74	1843 Indian Camp			X			X	
22.	45-PI-75	Crystallizer		X				X	
23.	45-PI-76	Sequalitchew Graves			X			X	It was the policy of the 1977 reconnaissance to create site records for several properties which were not actually located in the field. Histori-
24.	45-PI-77	Fort Lake Graves			X			X	cal references or informant accounts were used
25.	45-PI-78	Fort Nisqually Graves			X			X	in such cases.

5.0 Any Adverse Environmental Effects Which Cannot be Avoided Should the Proposed Action be Implemented

There are several unavoidable adverse impacts of the proposal. The more significant of these would be:

a. Elimination of 169 acres of wildlife habitat in the project upland area.

b. Elimination of three acres of wildlife habitat in Sequalitchew Creek canyon and degradation of the remaining 37 acres.

c. Formation of a barrier to animal movement in the ravine.

d. Increased human activity and noise along the DuPont shoreline. Modeling suggests that worst case nighttime noise levels would exceed Washington Advisory Code standards by 7 decibels on Anderson Island, Nisqually Reach and the western portion of the Nisqually Wildlife Refuge.

e. Lowered aesthetic value of the shoreline.

f. Increased navigational risks of vessel casualties, oil spills, and damage to recreational boats and commercial-fishing vessels.

g. An increase in the possibility of a major disruption to the Nisqually Delta ecosystem in the event of a major oil spill.

h. Interference with Nisqually tribal fishing activities.

Other unavoidable adverse impacts include:

i. Increased turbidity along the DuPont shoreline during removal of the wharf and construction of the new dock, including disturbances to intertidal and subtidal areas of Nisqually Reach.

j. Occasional on-site violation of state and local 24-hour suspended-particulate standards during construction.

k. Slightly increased emissions of air pollutants from vehicles and equipment (levels of pollutants would remain well within state and local standards).

l. Increased light and glare along the shoreline.

m. A small reduction in regional longshore employment from the advanced cargo-handling system.

n. Consumption of mineral resources and energy.

o. Destruction of sessile benthic organisms where pilings would be driven.

p. Low levels of hydrocarbons and heavy metals in treated stormwater runoff from the dock and access road would enter Nisqually Reach. Bioaccumulation of some of these contaminants would occur in marine organisms.

6.0 Alternatives to the Proposed Action

This chapter describes and analyzes alternatives to the proposed DuPont export facility. A variety of alternative sites, including public and private port facilities, are compared with respect to their potential to satisfy the requirements of the project and with respect to their potential environmental impacts. Descriptions and environmental impact comparisons of design alternatives for the export facility at the DuPont site are also summarized. In addition, the effects of not building the project at DuPont are examined (No Dock Alternative).

6.1 ALTERNATIVES AVAILABLE TO THE CORPS OF ENGINEERS

A permit for construction in navigable waters is required pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). The Seattle District, Army Corps of Engineers, is responsible for issuing a Section 10 permit for the construction of Weyerhaeuser's proposed export facility.

Three options are available to the Corps of Engineers:

(1) The Corps of Engineers may issue the permit as described in the Public Notice with no special conditions. Impacts arising from this option would include those described in Chapter 4 (Environmental Impacts of the Proposed Action).

(2) The Corps of Engineers may issue the required permit with special conditions (33 Code of Federal Regulations 320.4). The special conditions would mitigate and/or monitor adverse impacts resulting from the proposed action.

Mitigating measures that could be included in the permit as special conditions are discussed in Chapter 4.

(3) The Corps of Engineers may deny the permit. Should the permit be denied, the proposed action and associated impacts would not occur. Likewise, economic and social benefits associated with the development would not accrue. Biological systems at the site and the neighboring Nisqually Delta would continue to function as at present, unless alternative development were to occur.

Further discussions of impacts associated with this option follows in Section 6.2.

Even if the permit is issued, the Corps of Engineers has authority to modify, suspend, or revoke a permit for a variety of reasons, including non-compliance with permit terms and conditions, and a change of circumstances related to the authorized activity. (The Corps of Engineers would not be responsible for the environmental assessment of future projects that might occur in the upland portion of the DuPont site if these projects do not involve construction along the shoreline or in adjacent wetlands.)

6.2 NO DOCK ALTERNATIVE

If the Corps of Engineers were to deny the required permit, the proposed export facility could not be built. Although Weyerhaeuser would be able to continue exporting logs and forest products through its existing facilities, export capacity would be less than with the proposed project. Benefits to Weyerhaeuser resulting from an increased competitive ability in foreign markets would be foregone.

The DuPont site still has the potential to be used for other export functions if the proposed export facility were not constructed. The existing dock could be used without the requirement of new dock construction. Although the Congressional Record (20 January 1981) reported that a U. S. Interagency Coal Export Task Force has identified the DuPont site as among 13 potential West Coast sites that could potentially be used for coal export, it is unlikely that the existing dock would be capable of supporting such activities. New dock construction would be required. Although development of a new dock along the DuPont shoreline for some other use would not necessarily be precluded by denial of the Weyerhaeuser permit application by the Corps of Engineers, it would seem less likely than other development alternatives of the DuPont site that did not involve construction of a new dock.

Consequently the following discussion of alternative development possibilities for the DuPont site concentrates on alternatives involving no new dock construction.

Although a wide variety of alternative uses for the DuPont site might be imagined that do not include a dock or other waterfront development, details of such projects can only be speculative. At best, only general categories of alternative actions can be suggested and evaluated.

Three categories of "no dock" alternatives are discussed: (1) park or reserve, (2) industrial development not requiring an adjacent dock, or (3) residential development. Combinations of these alternatives are also possible.

Environmental impacts of these alternatives can be discussed only in general terms, since impacts would vary according to project details of each alternative or combination thereof. However, these alternatives would require detailed environmental impact assessment at some point prior to implementation.

6.2.1 No Development

The site cannot be expected to remain in its present state over the long-term unless action is taken to ensure that it does. If some group were to purchase the land to preserve open space and wildlife habitat, essentially all adverse environmental impacts described in Chapter 4 to the DuPont site and Nisqually Delta and Wildlife Refuge would be avoided.

Historically, use of the site by the DuPont Company left areas of the site relatively undeveloped as a safety requirement associated with explosives manufacturing. It is possible that portions of the site would remain relatively undeveloped in the future as open space or buffer, or possibly due to unsuitable development conditions. The extent of such uses cannot, however, at present be predicted.

6.2.2 Industrial Development

Because the DuPont site has historically had an industrial use, and is currently zoned industrial, it is likely that industrial development of the site, or portions of the site, would be a more likely "no dock" alternative than that discussed in Section 6.2.1. Weyerhaeuser Company might build sawmills, manufacture wood products of some type, develop an industrial or business park for sale or lease to highway/railroad oriented industries, or sell the entire site, or portions of the site, to some other company for industrial development.

Alternative industrial use of the site would avoid adverse environmental impacts caused by the presence of the dock and increased vessel traffic in southern Puget Sound. The Sequalitchew Creek ravine could remain as it is, without potential degradation of water quality or habitat; no disruption of the bluff or shoreline along Puget Sound would occur. Effects on air quality and groundwater in the DuPont area, including the Nisqually Wildlife Refuge, would depend on the specific project; impacts on the site and Delta could be more severe than those expected to result from the proposed export facility or less severe, depending on the type and degree of development of the site. Similarly, socioeconomic impacts would vary with factors such as the type and number of employees, and goods and services required by the new industrial development. Transportation impacts would also depend on the specific type of development; however, major road and rail access, with some adverse impacts such as habitat loss and increased noise in the access corridor, would be required for almost any industrial development.

6.2.3 Residential Development

The environmental impacts of residential development on the DuPont site would depend to a large degree on location, extent, and density. If most of the site, except areas of steep slopes, were subdivided, impacts could be quite severe. Archaeological and historical resources could be destroyed by construction or by pothunters unless excavation preceded development. Socioeconomic impacts would be particularly great. The expanded population would require substantial expansion of commercial and public services and utilities, particularly sewage treatment and water supply. If septic tanks were permitted, groundwater contamination might result. Runoff from impervious surfaces might impair water quality in Sequalitchew Creek. The adverse impacts of waterfront development and large ships would be avoided. Development of the Hoffman Hill area would be adjacent to the Nisqually Delta Wildlife Refuge; the only buffer remaining would be related to vegetation on steep bluffs and the elevation difference between the refuge and Hoffman Hill.

6.3 ALTERNATIVE SITES INITIALLY STUDIED

A large number of locations have been considered as alternative sites for the proposed export facility. Weyerhaeuser conducted an analysis of 29 potential locations for their future development activities, including the proposed export facility, during the two to three year period prior to their purchase of the DuPont site in January, 1976. Appendix N contains a document prepared by Weyerhaeuser in 1977 that summarizes their site selection process, which led to the choice of DuPont as their preferred alternative. Section 6.3.1.1 addresses Weyerhaeuser's site selection process.

The potential for locating the proposed export facility among existing Weyerhaeuser facilities and in existing public ports has also been assessed in the preparation of this NEPA document, and is presented in sections 6.3.2 and 6.3.3, respectively.

6.3.1 Weyerhaeuser's Site Selection Process

Weyerhaeuser developed certain characteristics to use in determining site suitability for the proposed export facility. These characteristics were ranked in one of three categories:

<u>Mandatory site requirements</u> - Characteristics which all must be satisfied for a site to be considered as a viable alternative.

<u>Critical site characteristics</u> - Characteristics of high priority that must be substantially met for a site to be considered.

Desirable site characteristics - Characteristics that are not essential for a site to satisfy, but which would be advantageous.

These requirements and characteristics are listed in Tables 30, 31, and 32.

6.3.1.1 Mandatory Site Requirements. Mandatory site requirements used by Weyerhaeuser in screening potential locations for the proposed export facility are presented in Table 30. This section describes these site requirements (as defined by Weyerhaeuser), and provides additional comment on the appropriateness of these criteria in the context of other planning in the Puget Sound area. It also describes the results of Weyerhaeuser's screening process of 29 potential sites using the mandatory site requirements.

To allow for flexibility in future ship use and design, a mandatory draft requirement of 40-60 feet was set by Weyerhaeuser for this project. This draft requirement appears reasonable in light of current projections in the Washington Public Ports Association's 1980 Port System Study (WPPA, 1980). According to this report, ships expected to be used in Puget Sound for forest products by the year 2000 will have design drafts of over 35 feet and require water depths of at least 40 feet. The report also states that bulk carriers for forest and other products will continue to increase in size at least to the Panamax limitation (limits imposed by the Panama Canal). According to a 1979 Maritime Administration report cited in WPPA's port study (1980), ships of this size have the following design characteristics:

Length overall (feet)	735 to 850
Breadth (feet)	104 to 106
Draft (feet)	41 to 46
Deadweight Tons	60,035 to 79,800

Ships expected to call at the proposed export facility would range in length from about 600 to 1,000 feet. A dock with a minimum length of 1,000 feet would allow one large ship or two smaller ships to be moored at the dock at one time allowing scheduling flexibility. The proposed dock is 1,320 feet long.

TABLE 30

WEYERHAEUSER'S MANDATORY SITE REQUIREMENTS

1. Marine water access.
2. Deep water access capable of allowing at least 40 but preferable 60 foot draft ships to dock and be loaded.
3. Capable of accepting a 1,000 foot dock.
4. Minimum of 200 acres of level adjoining property for unloading, staging and ship loading of logs and finished wood products.
5. Centralized location from the supply of logs and wood products.

TABLE 31

WEYERHAEUSER'S CRITICAL (HIGH PRIORITY) SITE CHARACTERISTICS

1. Additional acreage of a minimum of 300 acres within the site, contiguous or available in the vicinity for future wood products conversion facilities. Additional acreage must have off-highway transportation access to export facility.
2. Access to freeway or comparable highway within five miles of site.
3. Railroad access should be available.
4. Utilities, especially water and power, must be available to site.
5. Access to site without intrusion into residential or downtown areas.
6. Site must be available for purchase.

TABLE 32

WEYERHAEUSER'S DESIRABLE SITE CHARACTERISTICS

1. Industrial zoning.
2. Soil and geologic characteristics such that foundation and support requirements are minimal.
3. Minimal or no dredging required--especially for maintenance after initial construction.
4. Buffer areas available to reduce noise and visibility for adjoining residents.
5. Minimal land-filling of shoreline or adjacent properties required.
6. An available workforce and necessary housing for them in the project vicinity.
7. A minimum of noise-sensitive land uses adjacent to the site.
8. Minimal conflict with recreational use and fishing in the surrounding area.
9. Road and rail access to site with only moderate/reasonable grades.
10. Minimal site area in or near wetlands.

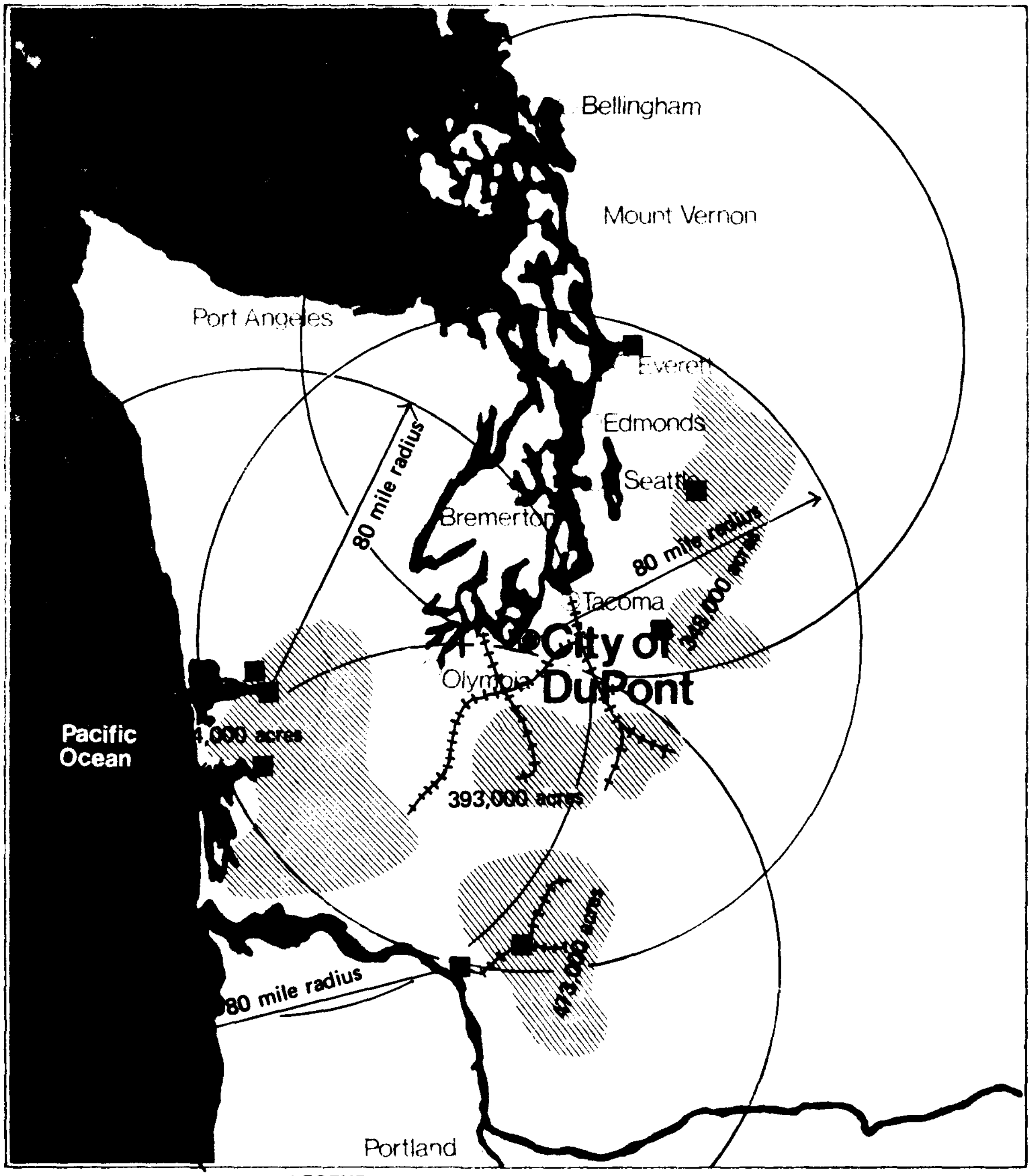
According to the 1980 Port System Study (WPPA, 1980), ships expected to be used in future forest products trade in Puget Sound would have a maximum length of about 850 feet. Lengths of new forest product berths anticipated by this study will be approximately 750 feet. Weyerhaeuser's proposed dock, capable of loading two ships at one time, would appear to be comparable to these planning estimates.

Centrality to log and finished wood product supplies was another important criterion involved in Weyerhaeuser's site selection process. Centrality to product supply was assessed by Weyerhaeuser from the standpoint of both distance and transit time from product sources. Figure 52 shows the locations of Weyerhaeuser production facilities and timber lands in the State of Washington.

Since the product mix that would be exported from DuPont is presently unknown, centrality can be judged only with regard to overall timber and finished product supplies. As shown in Figure 52, nearly all of Weyerhaeuser's timber lands and production facilities would be located within an 80 mile radius of the proposed site at DuPont, the Port of Tacoma, and the Port of Olympia. These three locations would be judged to be comparably central to Weyerhaeuser product supply. On the other hand, Figure 52 also shows that sites at Grays Harbor, Northern Puget Sound, and along the Lower Columbia River would be less central to Weyerhaeuser product supply. Significant areas of Weyerhaeuser timber lands would be farther than 80 miles from these locations. On the basis of such an analysis, it would be expected that lower transporation costs would be associated with a centralized location. It is possible, however, that if the majority of goods to be exported were from a single area, it would be more efficient to locate the export facility nearer that single area, rather than central to all sources of supply. Since the product mix is not presently known, it is not possible to assess this point from a transportation cost point of view.

A minimum of 200 adjoining acres for unloading, staging, and storage of logs and forest products was established on the basis of alternative conceptual designs for the export facility submitted to Weyerhaeuser by four engineering firms (Section 6.7). The alternative designs submitted ranged in acreage from 200-430 acres.

Throughput capacity estimates for modular terminals reported in the WPPA's 1980 Port System Study indicate that a single berth log terminal with 20 acres of backup storage should allow a throughput of 260,000 short tons/year. By extrapolation to Weyerhaeuser's proposed 2,000,000 short tons/year throughput, the acreage requirement would be 154 acres. Lumber throughput, however, based on 20 acres, is estimated in the 1980 Port System



Scale in Miles
25 50

LEGEND

Generalized Weyerhaeuser* Forest Holdings (approximate area indicated)

Weyerhaeuser Owned Railroads

Weyerhaeuser Production Facilities

FIGURE 52
WEYERHAEUSER PRODUCTION FACILITIES, FOREST HOLDINGS AND RAILROADS IN WESTERN WASHINGTON

*does not indicate precise ownership

Source: Weyerhaeuser Company

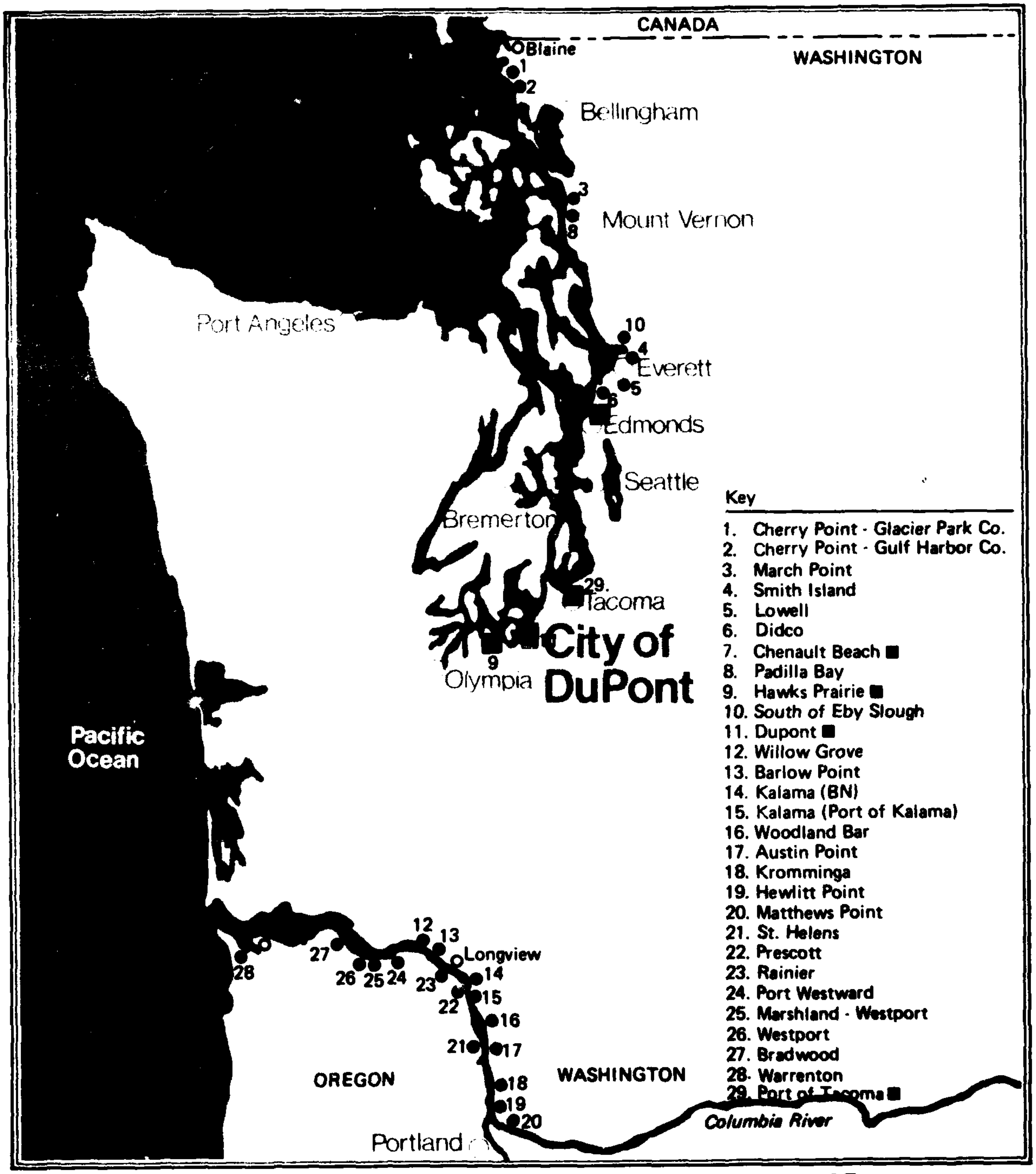
Study to be 130,000 short tons/year. Using this relationship the acreage required for the proposed throughput of 2,000,000 short tons/year would be 308 acres. Thus the 200 acre land requirement appears reasonable when compared to estimates generated from planning assumptions in the 1980 Port Study (WPPA, 1980).

Figure 53 shows the locations of 29 potential sites screened by Weyerhaeuser, using their mandatory site requirements. According to Weyerhaeuser's screening process, which is shown for all sites in Table 33, only the DuPont site met all mandatory site requirements without qualification. Two other sites, Chenault Beach and Hawks Prairie, met the mandatory site requirements, with one marginal rating. Sites which were rated marginal for two mandatory site requirements or which received a "no" rating for any mandatory site requirement were not considered further as viable alternatives.

The Chenault Beach site (identified as "Standard Oil" in Weyerhaeuser's summary document in Appendix N) met all requirements, but was rated marginal in terms of being central to product supply. The Hawks Prairie site met all requirements, but was rated marginal in terms of depth, because of a relatively long distance to water deep enough to accommodate ships proposed for the project. This draft constraint could be overcome by use of an approximately 1,800 foot long pier perpendicular from shore out to the 60 foot depth contour. Dredging to create sufficient depths closer to shore for deep draft ships would require the removal and disposal of large amounts of sediments. Also, since the development would be on the western portion of the submerged Nisqually Delta formation, dredging would probably alter normal patterns of sedimentation and erosion. Maintenance dredging would probably be required frequently due to deposition from the Nisqually River and littoral drift. As a result, it is unlikely that dredging would be a feasible alternative at Hawks Prairie.

Available land at the Port of Tacoma did not meet the acreage requirement for 200 adjacent acres. The Port of Tacoma was also considered marginal in terms of the depth of the currently maintained waterway. However, the Port of Tacoma land was suggested as a viable alternative during the SEPA EIS process and NEPA EIS process (the Seattle District Corps of Engineers received comments on the Port of Tacoma land at a public workshop in Tacoma and in comment letters addresssing the NEPA DEIS and the permit application public notices). Therefore, this site was carried through the analysis even though it did not meet all mandatory site requirements.

6.3.1.2 Critical Site Characteristics. The three sites that met the mandatory criteria, plus the available land at the Port of Tacoma were next screened by Weyerhaeuser against the critical site characteristics. Figure 54 shows the locations of these four sites. Table 34 presents the results of this screening.



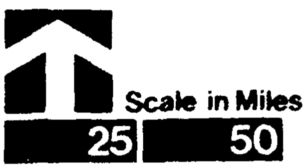


FIGURE 53
29 SITES INVESTIGATED

TABLE 33

SCREENING PROCESS - MANDATORY SITE REQUIREMENTS

Site	Requirement* (1) Marine	(2) Depth	(3) Dock	(4) Acres	(5) Central
1. Cherry Point (Gl Pk)	Y	Y	Y	Y	N
2. Cherry Point (Glf Hbr)	Y	Y	Y	Y	N
3. March Pt.	Y	M	Y	Y	N
4. Smith Island	Y	N	N	N	M
5. Lowell	N	N	N	Y	M
6. Didco	N	N	N	Y	M
7. Chenault Beach**	Y	Y	Y	Y	M
8. Padilla Bay	Y	N	Y	Y	N
9. Hawks Prairie**	Y	M	Y	Y	Y
10. Eby Slough	Y	N	N	Y	M
11. DuPont**	Y	Y	Y	Y	Y
12. Willow Grove	Y	M	Y	Y	M
13. Barlow Point	Y	M	Y	Y	M
14. Kalama (BN)	Y	M	Y	N	Y
15. Kalama (Port)	Y	M	Y	N	Y
16. Woodland	Y	M	Y	Y	M
17. Austin Point	Y	M	Y	Y	M
18. Kromminga	Y	M	Y	Y	M
19. Hewlitt Point	Y	M	Y	Y	M
20. Matthews Pt.	Y	M	Y	Y	M
21. St. Helens	Y	M	Y	Y	M
22. Prescott	Y	M	Y	Y	M
23. Rainier	Y	M	Y	Y	M
24. Pt. Westward	Y	M	Y	Y	M
25. Marshland	Y	M	Y	Y	N
26. Westport	Y	M	N	Y	N
27. Bradwood	Y	M	M	Y	N
28. Warrenton	Y	M	Y	Y	N
29. Port of Tacoma**	Y	M	Y	N	Y

Key

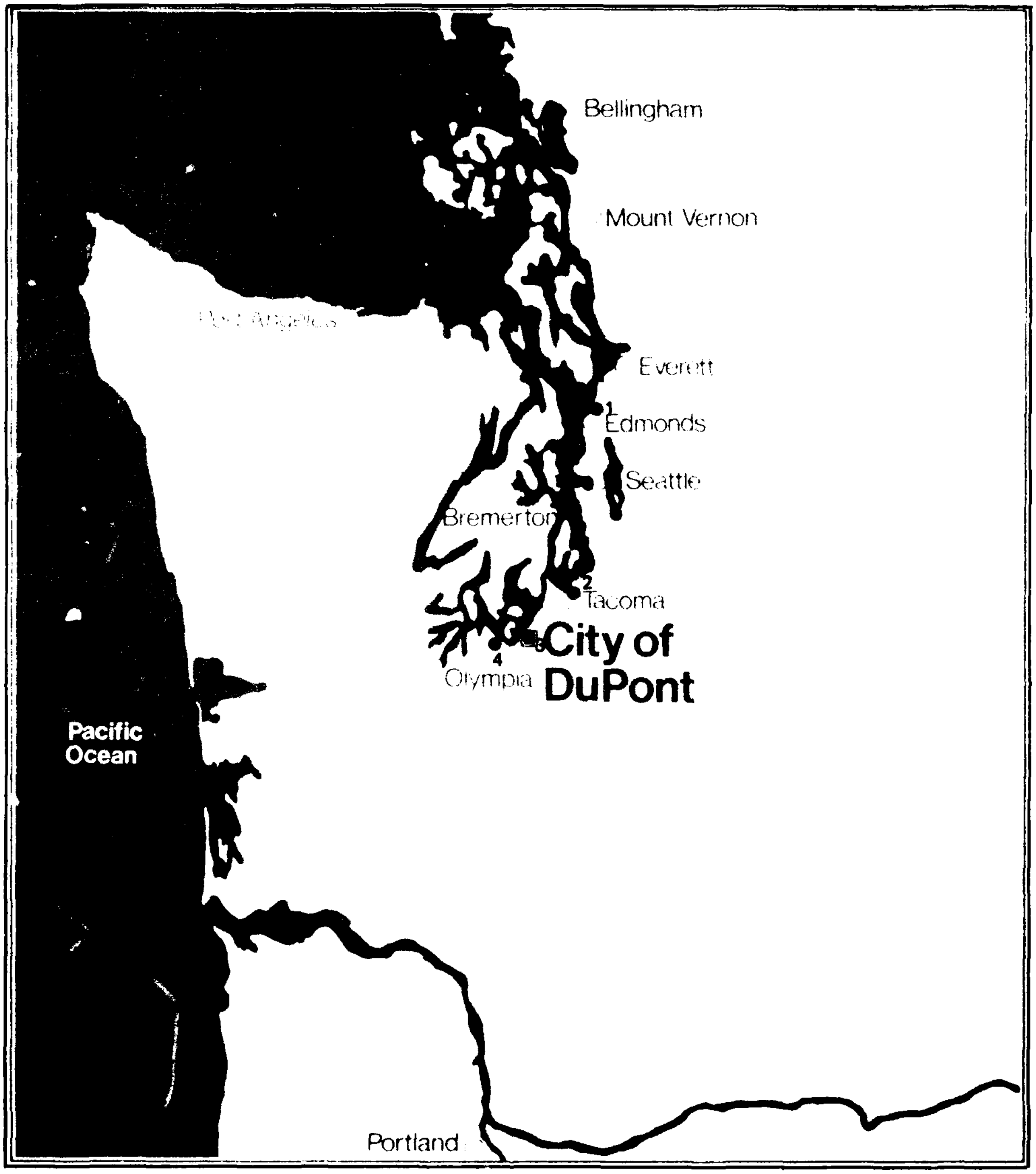
Y = yes; the site meets the mandatory requirement

M = marginal; the site marginally meets the mandatory requirement

N = no; the site does not meet the mandatory requirement

*See Table 30 for full statements of the mandatory site requirements

**The four sites selected for further consideration



Scale in Miles
25 50

Legend

1. Chenault Beach
2. Port of Tacoma
3. DuPont
4. Hawks Prairie

FIGURE 54
FOUR SITES SELECTED FOR FURTHER CONSIDERATION

TABLE 34

SCREENING PROCESS - CRITICAL SITE CHARACTERISTICS

Site	(1)* Acreage	(2) Freeway	(3) Railroad	(4) Utilities	(5) Access	(6) Purchase
1. Chenault Beach	Y	Y	Y	Y	M	M
2. Hawks Prairie	Y	Y	M	Y	Y	Y
3. DuPont	Y	Y	Y	Y	Y	Y
4. Port of Tacoma	N	Y	Y	Y	Y	N

* The numbers refer to the critical site characteristic described in Table 31.

Key

Y - Yes; the site meets the critical characteristic
M - Marginal; the site marginally meets the critical characteristic
N - No; the site does not meet the critical characteristic

DuPont, Chenault Beach, and Hawks Prairie met the critical site characteristics, although with some marginal ratings. At the time Weyerhaeuser screened the Chenault Beach alternative, its purchase availability was unknown. This led to Weyerhaeuser's marginal rating of the Chenault Beach site for this characteristic. The proximity of residential and commercial developments to potential access routes from Interstate-5 also led to a marginal rating.

The Hawks Prairie site met all the critical site characteristics, although Weyerhaeuser considered the distance from the Hawks Prairie site to railroad facilities marginal. The distance of the Hawks Prairie site from the Burlington Northern main line would be about six miles compared to approximately one and one-half miles at DuPont. The DuPont site received no marginal ratings in Weyerhaeuser's assessment. The Port of Tacoma did not meet the additional acreage characteristic. Available Port of Tacoma lands are available for lease, but not for purchase, a characteristic considered critical by Weyerhaeuser. Weyerhaeuser Company policy is to purchase land whenever possible on which their facilities are developed.

6.3.1.3 Desirable Site Characteristics. The four sites were next assessed with regard to the desirable site characteristics (Table 35). Weyerhaeuser's analysis indicated that the DuPont site most closely met the desirable site characteristics. The one marginal rating resulted from the location of Sequalitchew Creek in relation to the dock and dock access.

TABLE 35

SCREENING PROCESS - DESIRABLE SITE CHARACTERISTICS

Site	(1)*	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Chenault Beach	M	Y	Y	N	Y	Y	M	Y	M	Y
2. Hawks Prairie	Y	Y	M	Y	Y	Y	Y	M	M	Y
3. DuPont	Y	Y	Y	Y	Y	Y	Y	Y	Y	M
4. Port of Tacoma	Y	Y	N	Y	N	Y	Y	Y	Y	Y

* Refer to Table 32 for descriptions of desirable site characteristics

Key

Y - Yes; the site meets the desirable characteristic
M - Marginal; the site marginally meets the desirable characteristic
N - No; the site does not meet the desirable characteristic

6.3.1.4 Summary. Weyerhaeuser's site selection process involved screening 29 prospective sites using mandatory, critical and desirable site characteristics. Only Hawks Prairie, Chenault Beach, and DuPont met all the mandatory characteristics at a level acceptable to Weyerhaeuser. The Port of Tacoma land was carried through further analysis because of suggestions that it may be a suitable site for the proposed export facility. Screenings against critical and desirable site characteristics led Weyerhaeuser to the choice of DuPont as the preferred site of their proposed export facility.

6.3.2 Existing Facilities

Weyerhaeuser currently maintains private dock facilities at Everett, Tacoma, Aberdeen, Cosmopolis, and Longview. In addition, Weyerhaeuser unloads logs from trains at South Bay (between DuPont and Olympia) and occasionally has loaded log ships there. Furthermore, Weyerhaeuser leases a woodchip wharf on Blair Waterway from the Port of Tacoma (Figure 55).

Current target loading rates for "M" ships (44,000 DWT) at existing facilities are 400-500 tons/hour. Projected loading rates that are associated with the proposed project would be as high as 2,300 tons/hour. Logs are currently transported in ships of 18,000 to 30,000 DWT, which can reach all of their present docks, including their log export facility located on

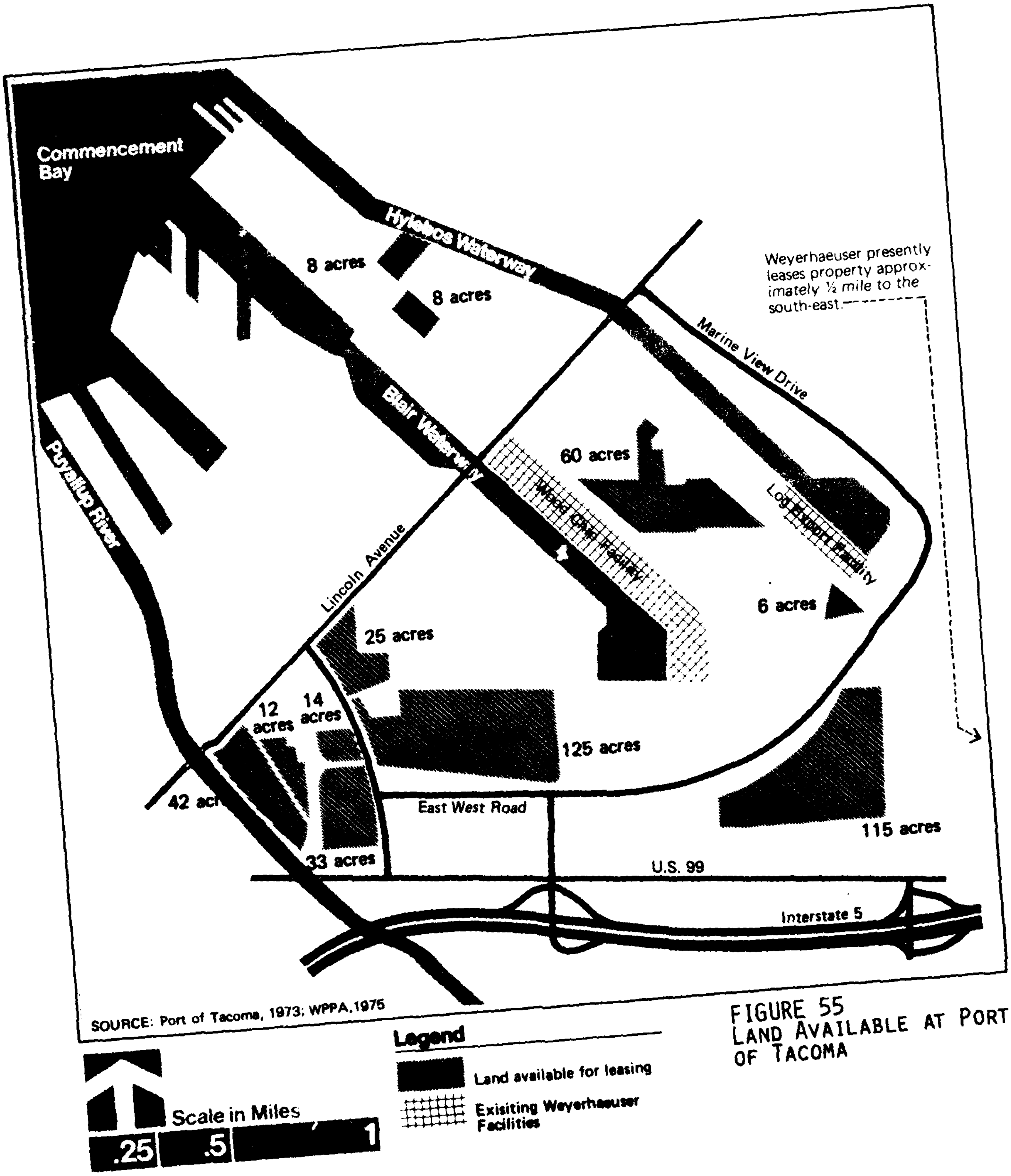


FIGURE 55
LAND AVAILABLE AT PORT OF TACOMA

Hylebos Waterway at the Port of Tacoma (Figure 55). Finished products, however, are presently transported in larger 44,000 DWT "M" and "J" ships which cannot reach facilities in Cosmopolis and Tacoma because of insufficient drafts and/or inability to pass under or through bridges. Although ships of this size have a design draft of 33 feet, additional depth (4 to 6 feet below MLLW) must be present below the propeller. Furthermore, ships expected to be used in the future for the export of finished wood products would range from 40,000 to 80,000 DWT with drafts up to 46 feet (WPPA, 1980).

Constraints on the size of ships that can call on Weyerhaeuser's Aberdeen and Cosmopolis facilities include the 30-foot depth (MLLW) channel in Grays Harbor, the Union Pacific bridge that restricts vessel beam to 85 feet, and the shallow water depth of the turning basin adjacent to the Aberdeen Mill dock and the Aberdeen Bay City log berth which limits arrival draft to 26 feet. It is possible that some of these constraints may be relieved by future dredging and bridge replacement projects that are currently under consideration by the Corps of Engineers. If these projects are developed, this site would meet the 40 foot draft requirement.

The water depth in Hylebos Waterway where Weyerhaeuser's log export facility is located at the Port of Tacoma is 35 feet, insufficient for the draft requirements of Weyerhaeuser "M" and "J" ships and those anticipated for future ships (WPPA, 1980). Maintenance dredging at the two berths occurs annually. Weyerhaeuser also leases a wharf on Blair Waterway from the Port of Tacoma which is used for wood chip exports. Although Blair Waterway marginally meets the draft requirement for future ships (draft varies from 35 to 45 feet depending on location), the East 11th Street Bridge is too narrow to allow passage of the Weyerhaeuser "M" and "J" ships and the larger ships of the future expected to call at the proposed export facility. Only the smaller ships in use can reach this facility. However, the Corps of Engineers has recently recommended to Congress that they authorize channel improvements, including deepening the channel and replacing the existing bridge with a new 300-foot horizontal clearance bridge. These improvements would allow passage of the Weyerhaeuser "M" and "J" ships. Congress has not yet authorized the project. Additionally, ships with draft requirements greater than 40 feet could potentially enter the channels and dock during high tides. Dockside dredging to create a "bathtub" adjacent to the dock would increase ship clearance enabling ships to remain afloat during lowest tidal stages. Frequent maintenance dredging of these "bathtubs" would be likely and would result in disturbance of biological communities. Further, this land is available for lease only, not for sale. Purchase of the site is a critical (high priority) characteristic, according to Table 31. Weyerhaeuser's existing facilities at the Port of Tacoma, therefore, cannot accommodate the proposed export facility.

Draft constraints also would limit the use of Weyerhaeuser's Longview facilities where the channel depth in the Columbia River is maintained at 40 feet. Berth water depth at Weyerhaeuser's Longview docks range from 34 feet MLLW to 37 feet MLLW. Maintenance dredging occurs annually. Weyerhaeuser's existing facilities lack sufficiently large storage and staging areas to

accommodate the addition of the volume of products associated with the proposed export facility. The available undeveloped areas at its existing facilities are separated from access to the docks by major public roads that would create serious logistical and safety problems. The Longview facility is currently Weyerhaeuser's largest forest products export facility and is expected to remain so even if the proposed facility is constructed.

6.3.3 Public Ports

No existing port district can accommodate Weyerhaeuser's proposed export facility without substantial modifications in the proposal. The following discussion provides information related to this conclusion. For example, reduction in the size of ships planned for use would relax draft constraints of existing ports. The use of smaller ships would, however, reduce, Weyerhaeuser's ability to achieve its planned objectives.

In addition to the four alternatives selected by Weyerhaeuser, the public port districts of Washington are considered in this EIS as alternative sites for Weyerhaeuser's proposed development. Including the Port of Tacoma, 34 public ports operate in the greater Puget Sound area (including Rosario Strait and the Strait of Juan de Fuca). From the point of view of state laws that govern port districts, any of these port districts has the authority to develop the kinds of facilities required by Weyerhaeuser. Development in an existing port would also be consistent with Washington State Marine Land Use policies and Puget Sound Council of Government policies that encourage the use of existing ports or development of new facilities in already developed areas.

The 1980 Port System Study (WPPA, 1980) states that by the year 2000 there will be a need for three additional lumber berths and four additional log berths in the Puget Sound area. Eight additional lumber berths and ten additional log berths will also be required in the Lower Columbia River and Washington Coast port areas. Although some of these berths might be supplied by conversion of existing general cargo handling facilities, new dedicated-use lumber and log handling facilities will be required, according to the study. In addition to these facilities, the WPPA study forecasts the statewide need for 12 additional deepwater berths for wheat export, 14 containerized general cargo berths, four new berths for coal exports, and a total of five new berths for wood chips, motor vehicles, and feed grains.

According to the WPPA study, it is likely that Washington Coast ports do not have sufficient land and waterfrontage to meet forecast needs. Ports of the Lower Columbia region will likely not have sufficient waterfrontage to meet forecast needs. Puget Sound ports, however, probably have sufficient acreage and waterfront to meet forecast needs if the available land is of a suitable size and location to accomodate the needed facilities. Some environmental constraints that might influence further expansion were identified in the WPPA study. For example, coastal wetlands issues might constrain port expansion at Grays Harbor and Everett. Tribal rights might affect future development at the Port of Tacoma, and land use constraints might influence developments at Seattle, Everett, and Olympia. Major concerns along the Lower Columbia are associated with dredging and dredged materials disposal. The port study states that available-acreage forecasts are not meant to indicate the amount of land that might or might not be developed. According to the report, port expansion is site-specific and

all or none of a port's available land might eventually be developed depending on environmental and other constraints.

Table 36 lists the public port districts currently operating in the Puget Sound area. Only 7 of these public ports are characterized as deep water marine terminals engaged in foreign and domestic waterborne commerce. Each of these ports currently handles some log and/or wood products. Water depths of channels are variable.

The remaining public port districts in Table 36 are primarily recreational and commercial fishing marinas, although a few have industrial development. Most of these ports are either located on islands in Puget Sound or on the west side of Puget Sound. As a result they are too remote in terms of distance and travel time from product supplies to meet the "centrality" requirement. The two small ports, Shelton and Allyn, that do meet the centrality requirement, are constrained by limited water depths and lack of 200 acres of contiguous upland space. None of these port districts are presently engaged in deep water marine commerce and all lack facilities required by the proposed project. Because of these considerations, these port districts are not viable alternative locations for the proposed export facility.

Public port districts in Washington State are also located in Grays Harbor and Willapa Bay and along the Columbia River. The Port of Grays Harbor does not meet the 200 contiguous acres requirement; the 1980 Port System Study (WPPA, 1980) indicates that only 45 acres of undeveloped Port lands are available for development. Additional property acquisition development may be constrained by coastal wetlands issues. Also, Grays Harbor is not favorable with respect to either the centrality requirement (Figure 52) or the 40 foot draft requirement. The depth of the navigation channel in Grays Harbor is currently maintained at 30 feet MLLW. In the future, the depth of the channel may be increased to 40 feet MLLW by the Corps of Engineers. This is contingent upon approval of project authorization/ funding by the U.S. Congress. Willapa Bay does not meet either the centrality requirement or the water depth requirement, and thus is not considered to be a viable alternative location for the proposed export facility. Lower Columbia River public ports are generally marginal in terms of the centrality mandatory requirement. The Columbia River channel, maintained at 40 foot depth, is marginal in terms of the 40-60 foot depth requirement. Because of these constraints, public ports along the Lower Columbia are not considered to be viable alternative locations for the proposed export facility.

Table 37 compares the seven deep water public ports of the Puget Sound area relative to Weyerhaeuser's mandatory site characteristics. Except for the centrality characteristic, these evaluations represent information obtained from port district officials. Table 37 indicates that none of these public ports meets all mandatory site requirements.

These seven ports have marine access and presently handle some forest products. The Ports of Seattle, Tacoma, and Olympia are clearly central to Weyerhaeuser's product supply. Of these, only the Port of Seattle has no draft constraints with respect to Weyerhaeuser's 40-foot draft requirements. The Port of Seattle cannot, however, provide a 1000 foot dock and cannot meet the acreage requirement.

TABLE 36

COMPARISON OF PUBLIC PORT DISTRICTS OF PUGET SOUND AREA

Port District	Deep Water Marine Terminal/Draft at MLLW		Present Log/Forest Products Handling Facilities	Industrial Development	Marinas	
					Recreational	Commercial Fishing
Seattle	Yes	40-50'	No Logs/Yes	Yes	Yes	Yes
Tacoma	Yes	Blair 35-45' Sitcum 35-50'	Yes	Yes		Yes
Anacortes	Yes	54'	Yes	Yes	Yes	Yes
Bellingham	Yes	34'	Few Logs/Yes	Yes	Yes	Yes
Everett	Yes	42'	Yes	Yes	Yes	Yes
Olympia	Yes	30'	Yes	Yes	Yes	
Port Angeles	Yes		Yes	Yes	Yes	Yes
Allyn					Yes	
Bremerton				Yes	Yes	Yes
Brownsville					Yes	Yes
Coupeville					Yes	Yes
Dewatto					Yes	
Edmonds					Yes	
Friday Harbor					Yes	Yes
Illahee					Yes	
Kingston					Yes	Yes
Langley				Yes	Yes	
Mabana					Yes	
Manchester					Yes	
Port Townsend				Yes	Yes	Yes
Poulsbo					Yes	
Shelton				Yes	Yes	Yes
Silverdale					Yes	
Skagit County				Yes	Yes	Yes
Tahuya					Yes	

Notes: 1. 9 other port districts occur in the Puget Sound region. None of theese are deep water marine terminals. They are Indianola, Key Port, Grapeview, Lopez, Orcas, Trayton, Waterman, and Hoodsport.
2. Absence of Yes indicates No.

Source: WPPA, 1978, 1980; Letter and telephone communications with selected port districts.

TABLE 37

PORT DISTRICTS OF PUGET SOUND REGION WITH DEEP WATER MARINE TERMINAL FACILITIES COMPARED WITH WEYERHAEUSER'S MANDATORY SITE REQUIREMENTS

Mandatory Site Requirements	Seattle	Tacoma	Anacortes	Bellingham	Everett	Olympia	Port Angeles
1. Marine Water access	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Deep water access (at least 40 feet draft)	Yes	Marginal	Yes	No*	Yes	No	No
3. Accept 1000 foot dock	No	Yes	No	Yes	No	Yes	Yes
4. 200 level, adjoining acres	No	No	No	Yes	No	No	No
5. Central location	Yes	Yes	No	No	Marginal	Yes	No

*Present facilities are limited to 34' draft in Bellingham Bay; however, at Cherry Point land is available with access to 40 foot draft waters. The Port of Bellingham is county-wide.

Source: Letter and telephone communications with the port districts; URS, 1980.

The draft depth at the Port of Olympia is maintained at 30 feet, with maintenance dredging of the entrance channel and turning basin required about every 10 years. The Port of Olympia also does not have 200 level, adjoining acres available in close proximity to pier facilities. This draft limitation alone precludes the Port of Olympia from further consideration, unless dredging is conducted to substantially increase draft depth.

The draft at the Port of Tacoma varies from 35 to 45 feet in Blair Waterway and from 35 to 50 feet in Sitcum Waterway, depending on the location within each waterway. Maintenance dredging is accomplished at approximately ten year intervals. Since Weyerhaeuser's draft needs are stated at 40 feet, and preferably up to 60 feet to provide maximum flexibility for future ship design, the Port of Tacoma's capacity to accommodate Weyerhaeuser's stated draft requirements is rated as marginal. As noted earlier (Section 6.3.2), a project not yet approved by Congress to deepen Blair Waterway and provide greater horizontal bridge clearance, would allow ships with 40 foot or greater drafts to use the Blair Waterway. Relative to the 200 adjoining acres requirement, letters from the Port of Tacoma to Weyerhaeuser and URS Company dated October 17, 1978, October 12, 1978, and June 11, 1980 (Appendix O) indicate that the port does not have 200 contiguous acres with direct

access to 40 foot draft waters. There are, however, smaller parcels in various locations around the waterways. Figure 55 indicates the locations of land available for lease at the Port of Tacoma. Available parcels include 115-acres bordering East-West Road, a 60-acre parcel between Taylor Avenue and Alexander Avenue, and 125-acres on Marshall Avenue. Additional parcels totaling 126 acres are available near the latter site.

"Split" development of the export facility on two or more of these parcels would result in a high loss of efficiency due in part to problems associated with transporting large, bulky loads with off-highway vehicles. Movements between sites and to ships would necessitate use of such vehicles on port roadways, resulting in congestion and safety hazards.

Although the port is heavily involved in the handling of logs and wood products, the expressed policy of the Port of Tacoma is to diversify its industrial base and it "...is also attempting to diversify its remaining terminal areas among several steamship companies which call on ports throughout the world. This will provide the worldwide service so sorely needed by our Pierce County business firms which export and import" (letter in Appendix O dated June 11, 1980). The Port of Tacoma does meet the marine access, 1000 foot dock, and centrality requirements. It also satisfies most of the critical site characteristics considered to be of high priority by Weyerhaeuser. However, it fails to meet the purchase site characteristic as land is available for lease only.

While the Corps of Engineers considers the Port of Tacoma location as the environmentally preferred alternative (among the alternatives assessed in Section 6.4.5), the Port of Tacoma does not meet Weyerhaeuser mandatory acreage requirement and would only marginally meet the draft requirement. With Congressional authorization and completion of the Corps of Engineers Blair Waterway project, this waterway would then meet the draft requirement.

6.4. FOUR ALTERNATIVE SITES SELECTED FOR FURTHER CONSIDERATION

The four sites selected for detailed consideration are shown in Figure 54. Each of these sites is described briefly in this section, and sites are compared, with respect to the overall environmental impact anticipated from development of an export facility (Table 39).

6.4.1 Hawks Prairie Site

The Hawks Prairie site is a 1,200-acre wooded site west of the Nisqually Delta. The upland portion of the site is gently rolling and covered by a dense stand of Douglas fir mixed with Oregon oak. Access to water is by a relatively narrow corridor (about 1,300 feet wide) down a steep, unstable

hillside covered with alder, ferns, and brush. A long T-shaped pier approximately 1800 feet long on the western edge of the site would be required to reach 60 foot deep water. Extension of the existing road leading to the Atlas Powder Company Dock would have to cut into the steep bluff, since the beach is completely covered at high tide. The site would be approximately six miles from the Burlington Northern main line; a new spur would be required.

6.4.2 Chenault Beach Site

The Chenault Beach site is a 2,200-acre wooded site in Snohomish County, west of Paine Field. The upland portion of the site is 500 feet above Possession Sound, which borders the western edge of the site. Much of the site is dominated by very steep slopes that lie adjacent to the Sound. These bluffs are mostly covered by a dense growth of alder and big-leaf maple; however, some portions are covered only by horsetails and salmonberry. At the base of the bluff, the Burlington Northern Railroad right-of-way runs along a riprap embankment. No dredging would be required.

Residential developments surround the site, except on the east; development of areas with a view of the Sound is occurring rapidly. In early 1980, a residential subdivision was being developed in the northern portion of the upland area, and an industrial park was being established along Chenault Beach Road to the south of the residential subdivision. Hence, it seems unlikely that this alternative is still viable.

6.4.3 DuPont Site

The DuPont site is the 3,200-acre site northeast of the Nisqually Delta. Detailed information on this site is presented in Chapter 2.

Solo Point, located approximately two miles northeast of the DuPont site on the same shoreline, has been considered by the resource agencies as an alternative dock location to be used with the DuPont site. The most significant problem with locating the dock at Solo Point would be incompatibility of dock activities with Fort Lewis' shoreline training exercises and the extensive recreational uses that occur in the Solo Point area. The Army's decision not to approve a lease of real property to Weyerhaeuser precludes Solo Point as a viable alternative dock location (Appendix O). A complete description of the Solo Point alternative and an environmental impact comparison with the proposed dock location has been included in Appendix Q.

6.4.4 Port of Tacoma

Land available for development at the Port of Tacoma is shown in Figure 59. Available large parcels include a 115-acre parcel bordering East-West Road, a 60-acre parcel between Taylor Ave. and Alexander Ave., and a 120-acre parcel on Marshall Ave. Additional small parcels totaling 126 acres are available near the latter site. These parcels are not contiguous. They would be possible, but difficult to develop for the proposed project. Additional land to build a specialized dock and loading facilities is not available.

In addition, long term use of the site would not be guaranteed because the property is available for lease only, ' ¿ the Port of Tacoma is not actively seeking to attract this type of facility. Heavy industrial development, shipping, and related services characterize the area. Additional discussion concerning the Port of Tacoma's suitability for the proposed export facility is presented in Section 6.3.

6.4.5 Environmental Comparsion

Development of an export facility would be associated with certain environmental impacts such as increased noise levels and increased traffic volumes, no matter which of the alternative sites is developed. The following comparisons focus on environmental impacts that would differ among the sites.

6.4.5.1 Water Quality. Differences in water quality impacts would be expected. Of the four sites considered, the greatest impact on marine water quality could be associated with development of the Hawks Prairie site, because the discharge of the Nisqually River tends to trap pollutants introduced to the west of the Delta (U.W. Department of Geological Sciences, 1971). Pollutants introduced at the DuPont site would also affect water quality in the Nisqually Reach; however, such pollutants are likely to remain in the reach for a shorter period of time than those introduced to the west of the Nisqually River. Pollutants introduced near the Chenault Beach site would disperse more rapidly than in southern Puget Sound due to the more effective tidal circulation. In addition, Chenault Beach is not located close to any sensitive, relatively unpolluted estuaries.

Water quality near the Port of Tacoma has already been impacted by shipping and industrial activity. It is unlikely that further significant decreases in water quality would accompany locating the proposed export facility at the Port of Tacoma. However, resuspension of bottom sediments due to propeller turbulence would increase turbidity and concentrations of heavy metals and organics in the water column.

Surface freshwater quality would be unaffected at the Hawks Prairie and the Chenault Beach sites, since neither has any streams or lakes. The proposed development at DuPont would adversely affect water quality in Sequalitchew Creek to a minor degree. The highly permeable soils on the DuPont and Hawks Prairie sites have a potential for groundwater contamination not present on the Chenault Beach or Port of Tacoma sites.

6.4.5.2 Air Quality. Some air pollutant emissions would be expected as a result of construction and operation of the export facility at any of the sites considered. Expected sources are ships, trucks, railroad engines, and fugitive dust from construction and other operations. Their impacts would depend in part on existing air quality at the alternative sites. Impacts on air quality would be greatest at the Port of Tacoma where existing air quality is poorest. Impacts at the other sites would be minor.

6.4.5.3 Flora and Fauna. Compared to impacts on flora and fauna at the Port of Tacoma, impacts would be more substantial at the other sites. Marine resources adjacent to each site are listed in Table 38. A number of marine resources would be affected at any of the alternative sites. Relatively fewer resources would be affected at the Port of Tacoma. Marine resources affected at the remaining sites would be about the same. Both the Hawks Prairie and DuPont sites are adjacent to a "major waterfowl area" that includes the *Nisqually Delta Wildlife Refuge* (Washington State Department of Natural Resources, 1972).

TABLE 38

SELECTED MARINE RESOURCES PRESENT IN SITE VICINITY

Resource	Chenault Beach	Port of Tacoma	Hawks Prairie	DuPont
Pacific Oysters	-	-	+	+
Olympia Oysters	-	-	+	-
Geoducks	+	-	+	+
Shrimp	-	-	+	-
Crabs	+	-	-	-
General Sports Salmon Fishing Area**	+	+	+	+
Concentrated Sports Salmon Fishing Area**	+	+	-	+***
Commercial Salmon, Gill Net	+	+	-	+
Non-Salmon Sports Fishing	+	-	+	+
Bottom Fishing Area	-	-	+	+
Eelgrass Beds	-	+	+	+
Waterfowl	-	-	+*	+*

+ resource present
- resource not present

* Adjacent to Nisqually Delta, a major waterfowl area.
** Areas identified as Concentrated Sports Salmon Fishing receive heavier use by sports fishermen than do general areas.
*** Concentrated sports fishing offshore from Nisqually delta and southern tip of Anderson Island.

Source: Washington Marine Atlas, Vol. 2. South Inland Waters, State of Washington Dept. of Natural Resources. October, 1972.
Washington Dept. of Fisheries, personal communication, 1980.

The upland areas of the Hawks Prairie and Chenault Beach sites are covered with second growth forest dominated by alder, maple, and Douglas fir. These forests are typical of second growth forest in the Puget Lowlands. Although habitat loss would occur for a variety of animal species, sensitive, high quality habitat such as the Sequalitchew Creek canyon at DuPont does not occur at the other sites. The Hawks Prairie and Chenault Beach sites do not have streams or wetlands important for fisheries; Sequalitchew Creek at DuPont has some importance to fisheries and is associated with a small (0.5 acre) wetland (Chapter 2).

6.4.5.4 Soils. The suitability of the soils and underlying geological formations for the proposed development varies. The Hawks Prairie site is probably least suitable, since the bluff along the shoreline is composed of Kitsap silt loam overlying Kitsap formation; such slopes are unstable, a particularly great hazard in view of the seismicity of the region. The bluffs along the DuPont site are more stable and not quite as steep. The bluffs along the Chenault Beach site are much higher (500 feet) and very steep; removal of vegetation or disturbance of the soil would probably cause severe erosion or landslides. Evidence of past wasting of the bluff can be seen from the railroad tracks near the Chenault Beach site. Therefore, access to the waterfront would be difficult and road construction could result in significant adverse impacts. A small canyon does exist through which access might be possible with less impact on the bluffs. The upland portions of the three private sites provide few geological limitations for development except that the DuPont and Hawks Prairie sites have potential for groundwater contamination and the Chenault Beach site soils are unsuitable for septic tanks (USDA; 1958, 1971, 1978). None of these problems would be associated with the Port of Tacoma site.

6.4.5.5 Noise. Proximity to sensitive noise receptors and the nature of such receptors also varies with the site. At the Port of Tacoma, additional noise would contribute to the port area noise level, but would not be expected to result in a significant cumulative adverse impact. Both the Hawks Prairie and the DuPont sites are sufficiently close to the Nisqually Delta Wildlife Refuge that increased noise levels might adversely affect waterfowl and other fauna using that area. Residential areas near the DuPont Site, except those on Anderson Island, would probably be unaffected. In contrast, the corridor to the waterfront of the Hawks Prairie site would be within 500 feet of residential use. Few residences that would be subjected to increased noise are situated along the highway access route to the Chenault Beach site; however, significantly increased noise levels in the residential areas bordering the site along the waterfront and adjacent to the upland to water-front access corridor would be probable. Also, residences northward from Possession Point along the east side of Whidbey Island could be affected by noises across water generated by dock activities.

6.4.5.6 Indian Treaty Fishing Rights. Location of the proposed export facility at the DuPont site is expected to impact Indian fishermen to a minor degree (Section 4.8.8). The shorelines at DuPont, Sequalitchew Creek, and the Nisqually Delta are designated as usual and accustomed fishing areas according to interpretations of Indian treaty fishing rights. The extent of

impact on treaty fishing would not be expected to significantly affect Nisqually and Squaxin tribal fishing. Development of Hawks Prairie, too, would also affect Indian treaty fishing rights, since this alternative site is located adjacent to the Nisqually Delta. Commencement Bay, containing the Port of Tacoma, is designated as a usual and accustomed fishing area for the Puyallup tribe. The waters off Chenault Beach are also designated as a usual and accustomed fishing area for the Tulalip Tribe, as well as the Lummi Tribe. It is unlikely that development of the proposed export facility at the Port of Tacoma or at Chenault Beach would have a significant impact on treaty fishing at any of these sites.

6.4.5.7 Zoning/Land Use. Incompatibility with existing shoreline zoning would present problems at the Hawks Prairie site. Urban zoning of the Hawks Prairie site is considered inappropriate by the Thurston County Planning Department (Thurston County Commissioners, 1976) and many local citizens. Industrial zoning of portions of the upland section of the Hawks Prairie site is also questionable. The Port of Tacoma and DuPont sites have an "Urban" classification. Development of the Port of Tacoma and DuPont sites would be consistent with present zoning. The DuPont Shoreline Master Program designated the proposed dock location shoreline as "Urban", however the alternative dock location has a shoreline that would have to be reclassified from "Conservancy" to "Urban" in order to accommodate the dock at this location. The majority of the Chenault Beach shoreline is classified "Conservency;" however, an "Urban" area sufficient to accommodate the proposed dock is designated. Existing land use consists of open space and low density residential areas near Chenault Beach.

6.4.5.8 Traffic. Adverse traffic impacts would be greatest for the Chenault Beach site, since the access road would pass through residential areas. No traffic through residential areas would be required for access to the other sites.

6.4.5.9 Recreational. Recreational impacts would be greater for the sites south of Tacoma. Weyerhaeuser ships traveling to and from southern Puget Sound might cause minor interference with recreational boating activities in central and southern Puget Sound. Ships to Chenault Beach would avoid travel through central and southern Puget Sound areas used for recreational boating activities. The Hawks Prairie site would be most likely to disrupt recreation since it is close to Tolmie State Park, a waterfront/underwater park.

6.4.5.10 Socio-economic. Growth-related impacts induced by an additional 150 employees would not be severe for any of the sites. Such impacts would be negligible for the Tacoma site. The Chenault Beach site is in an area presently experiencing rapid urbanization, so an addition of 150 households would probably not be significant. DuPont is furthest from urban areas that would provide housing and other services to workers, while the Hawks Prairie site is somewhat closer to urbanizing areas. Overall, there would be little significant difference in socioeconomic impacts between the four alternative sites.

6.4.5.11 Aesthetics. Aesthetic impacts would vary. The Chenault Beach site presents a pleasing appearance from all sides. The dock and an access road down the series of steep bluffs and gulches would be visible to residents along the shores on Whidbey Island. Since much of the vegetation is deciduous, careful siting of the log handling and storage area would be

required to maintain an adequate visual buffer. Similarly, an access road and dock facilities at the Hawks Prairie site would be visible from adjoining residential development and from Tolmie State Park. A coniferous forest would buffer adjoining areas from visual impacts of development on the upland portion of the Hawks Prairie site. Fewer residences would experience adverse visual impacts at the DuPont site. Waterfront development at any of the three sites would be visible to recreational boaters. No increase in adverse visual impact would be anticipated with development of the Port of Tacoma site.

6.4.5.12 Historical/Archaeological Resources. No known cultural resources listed or eligible for inclusion in the Register of National Historical Places would be impacted by development of the proposed project as now conceived at the DuPont site (Section 2.20).

No impacts on historical or archaeological resources would be expected at the Port of Tacoma. No resources of this type are known to exist on the Chenault Beach and Hawks Prairie sites, although no systematic survey has been carried out. A survey would be recommended by the State Historic Preservation Officer should either of these sites be proposed for development. It is possible that previously unknown resources could be found on either of these sites before or during development.

6.4.5.13 Summary. Table 39 provides an environmental impact summary that compares the four sites selected for further analyses. The table emphasizes differences in expected impacts between the sites. The Port of Tacoma is favored overall by this impact comparison; however, the constraints of insufficient draft and limited contiguous land availability are such that the sites cannot be considered a viable alternative. Of the remaining three sites, impacts on the natural environmental would be greatest if the proposed export facility were located at either DuPont or Hawks Prairie. Although marine resources and upland habitat would be lost at Chenault Beach, overall impacts would probably be of lesser magnitude than at DuPont or Hawks Prairie which are located adjacent to the Nisqually Delta. Also, loss of Sequalitchew Creek habitat at DuPont would be a significant loss of wildlife habitat. Drawbacks of the Chenault Beach and Hawks Prairie sites are associated with the proximity of existing and prospective residential areas to the site. Increased noise levels would no doubt significantly affect these residences. Locating the export facility at DuPont would probably have relatively less effect on residential areas.

6.5 PRELIMINARY SITE ANALYSIS

After DuPont had been selected by Weyerhaeuser as the most desirable of the alternative sites, Weyerhaeuser retained William L. Pereira and Associates to plan the conceptual layout of the site. Their task was to determine the best area to locate the facility.

TABLE 39

COMPARISON OF POTENTIAL IMPACTS ON FOUR ALTERNATIVE SITES

	Chenault Beach	Hawks Prairie	DuPont (Proposed site)	Port Of Tacoma
Water Quality	Rapid dispersal of pollutants into Puget Sound; lowest impact potential of the four sites.	Potential for groundwater contamination; pollutants would be trapped by Nisqually River.	Potential for groundwater contamination; potential impacts on Nisqually Delta and Nisqually Reach.	Degradation of already marginal water quality.
Air Quality	Minor impact	Minor impact	Minor impact	Greatest relative impact.
Flora and Fauna	Loss of forest habitat; some loss of marine resources,	Loss of forest habitat, some loss of marine resources; adjacent to Nisqually Delta and Wildlife refuge.	Some loss of Sequalitchew Creek habitat; some loss of marine resources; adjacent to Nisqually Delta and Wildlife refuge.	Neligible impact.
Earth/ Geology	Steep, high bluff may cause severe erosion and slides; however development in small canyon may preclude this.	Unstable Kitsap formations on bluff have slide potential	Stable, less steep access through Sequalitchew Creek canyon to dock.	Negligible impact.
Noise	Potential residential impacts.	Potential residential impacts; potential wildlife impacts.	Potential residential impacts; potential wildlife impacts.	Small incremental increases in existing industrial area.
Indian Treaty Fishing Rights	Designated as usual and accustomed fishing area.	Near designated areas at mouth of Nisqually River and surrounding bay.	Niqually Reach and Sequalitchew Creek are designated as usual and accustomed fishing areas.	Commencement Bay is designated as a usual and accustomed fishing area.

TABLE 39 (Continued)

COMPARISON OF POTENTIAL IMPACTS ON FOUR ALTERNATIVE SITES

	Chenault Beach	Hawks Prairie	DuPont (Proposed site)	Port Of Tacoma
Land Use	Consistent with land use and shoreline desig-. nations	Urban designation felt to be inappropriate; adjacent to Shoreline of Statewide Significance	Proposed dock location consistent with urban designation; alternative dock location inconsistent with present zoning; in Shoreline of Statewide Significance.	Consistent with zoning.
Traffic	Traffic through residential areas.	Traffic near residential areas.	New access route required from I-5.	Increased congestion in port area.
Recreational	Might have minor impacts on recreational fishing and shell fishing.	Minor impacts on recreational fishing, boating, shellfishing; near Tolmie State Park.	Might have minor impacts on recreational boating, fishing, shellfishing.	No significant impacts.
Socio-economic	Equivalent impacts expected for all four sites.			
Asethetics	Greatest visual impacts on nearby residential areas and from Puget Sound and Whidbey Island.	Some visual impacts on nearby residential area and from Tolmie State Park; might have noise impacts in Nisqually Wildlife Refuge.	Visual impacts from Puget Sound and Anderson Island. Noise impacts in Nisqually Wildlife Refuge.	No significant impacts.
Archaeological/ Historical Resources	Potential impacts on important archaeological and historical resources.	Potential impacts on important archaeological and historical resources.	Potential impacts on important archaeological and historical resources.	No impacts expected.

A number of studies of existing conditions on and near the site were also initiated. Pereira used data from these baseline studies and information from the literature to define development constraints with respect to environmental factors such as slope, archaeological and historical sites, drainage patterns, and proximity to sensitive areas including the Nisqually Delta, Edmond Marsh, Sequalitchew Creek and Canyon, Old Fort Lake, and Hoffman Hill. Other factors used to identify portions of the site suitable for industrial development included ownership, leases and easements. Potential development areas on the site identified by this process are shown in Figure 56.

These potential development areas were analyzed in conjunction with Weyerhaeuser's stated requirements: a 200 to 500-acre facility, access to deep water, and an adequate buffer between industrial and other land use. This analysis identified the three overlapping areas shown in Figure 57 as potential industrial sites.

Pereira and Associates evaluated these areas with respect to physical characteristics, environmental features, land ownership, access, and operation of the proposed facility.

The evaluation indicated that the northern portion of the site would be most favorable for the proposed development. This site is located completely north of Sequalitchew Creek and Edmond Marsh. Much of this land is now leased to the U.S. Army for use as a landfill and for training areas. Although selection of this site would require longer major access routes and modification of the Army's lease, this site is the farthest removed from the Nisqually Delta and the Village of DuPont, and offers the most flexibility in dock location.

The central site has the largest area. It encompasses land on both sides of Sequalitchew Creek, including most of the area used by the E.I. duPont Company, and Old Fort Lake. The major disadvantage of this site is the potential for adverse impacts on the natural environment and on historical and archaeological resources.

The southern site includes most of the property south of Sequalitchew Creek except the Hoffman Hill area and a wide buffer around the Village of DuPont. Old Fort Lake and most of the industrial area used by the DuPont Company would be within the boundaries of this area. This site combines the environmental disadvantages of the central site with the greatest proximity to the Nisqually Delta, Hoffman Hill, and the Village of DuPont.

6.6 ALTERNATIVE ROAD AND RAIL ACCESS TO THE DUPONT SITE

An export facility requires that linkage between other modes of transportation and tranfers to other carriers be accomplished effectively and efficiently. In the present case, access is required for trucks, trailers, and rail cars bringing logs and finished wood products from Weyerhaeuser mills and forests to the DuPont site for transfer to ocean-going vessels.

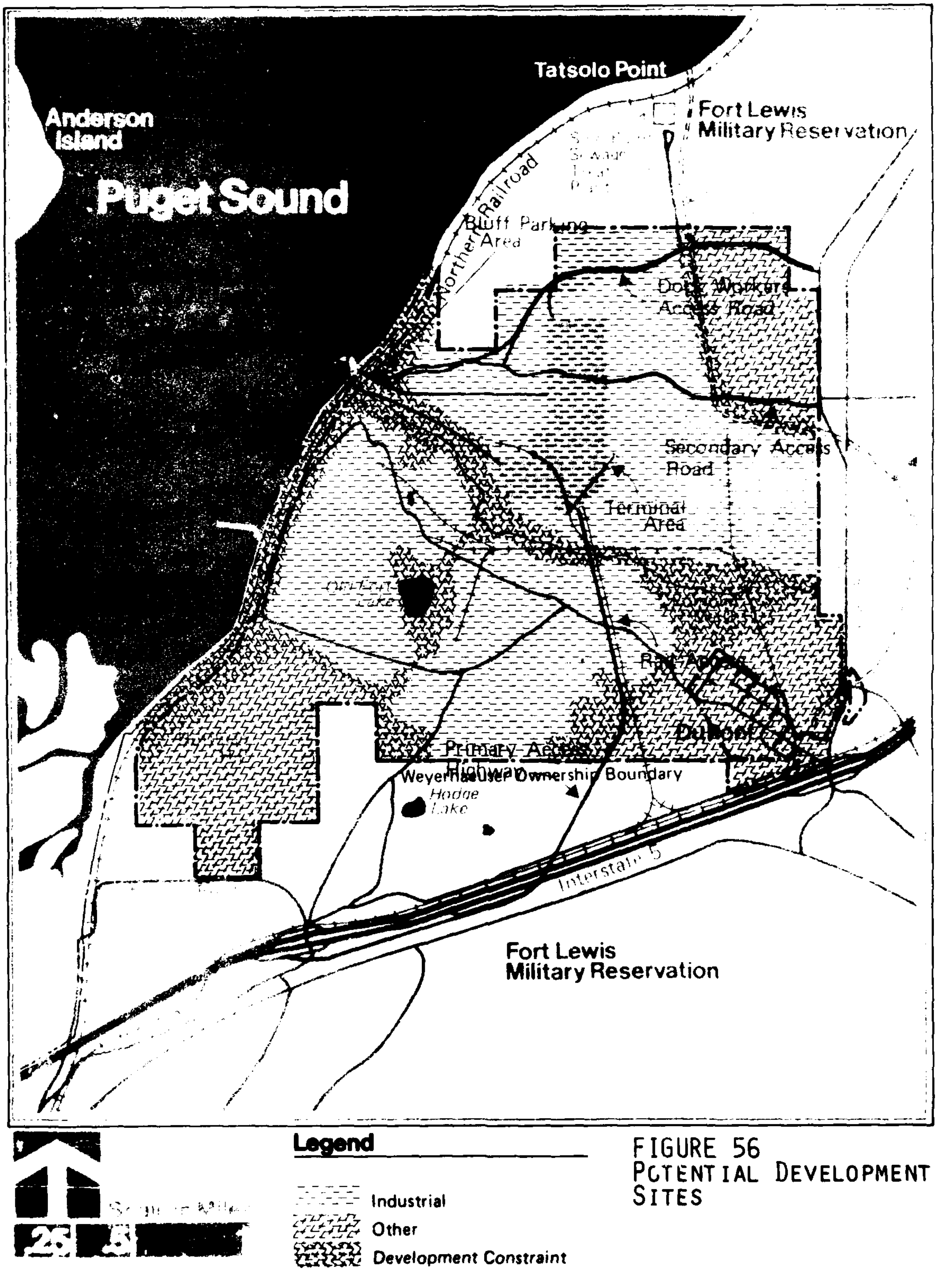


FIGURE 56
POTENTIAL DEVELOPMENT
SITES

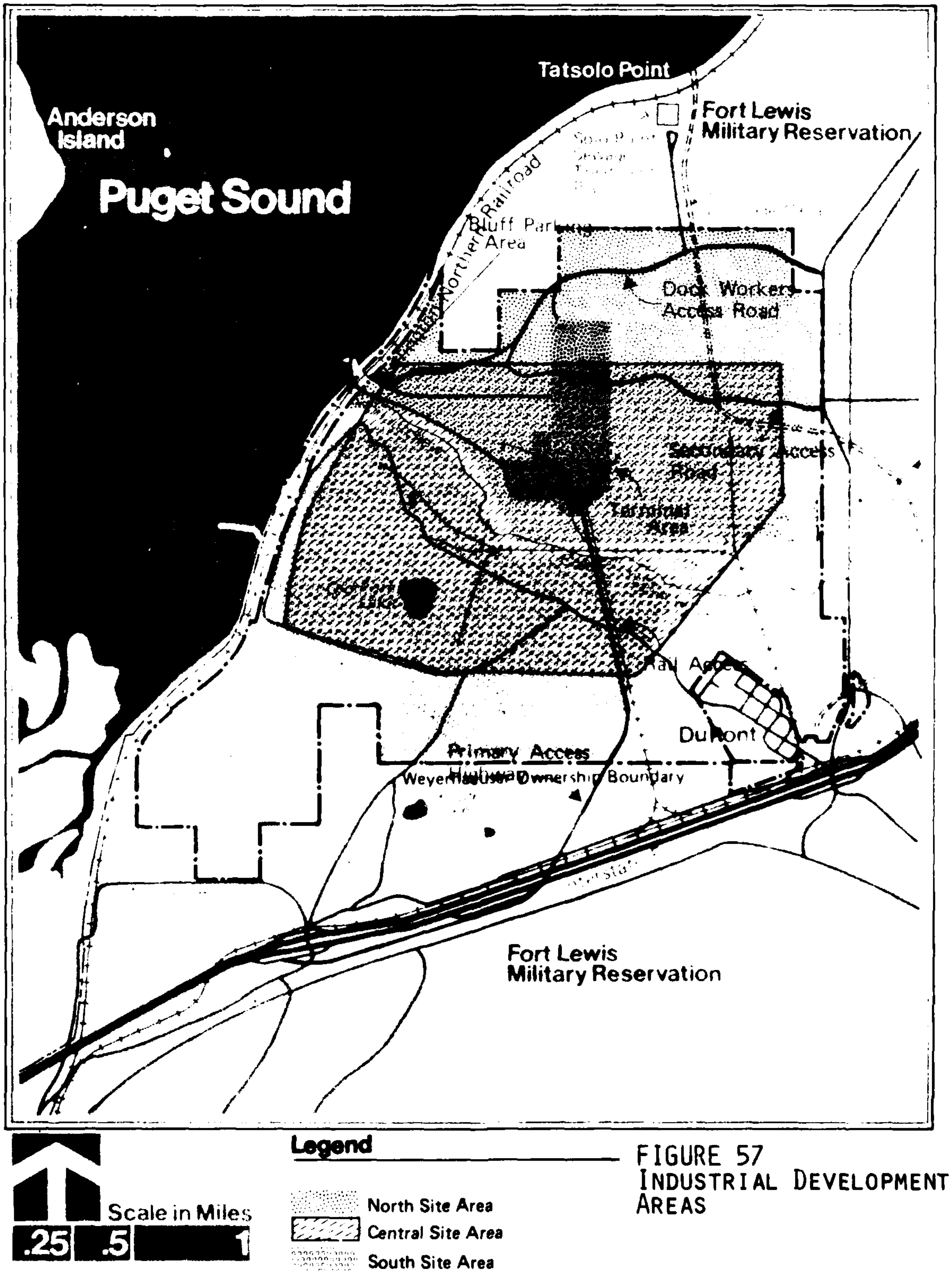


FIGURE 57
INDUSTRIAL DEVELOPMENT
AREAS

Eight road access alternatives as well as eight railroad access alternatives, were identified by Weyerhaeuser and compared. A single transportation corridor for both road and rail access was then selected as the proposed alternative by representatives of Weyerhaeuser, the City of DuPont, Fort Lewis, and the Washington Department of Transportation. (See Project Description Section 1.3.)

Detailed descriptions of the 15 transportation access alternatives can be found in Appendix N.

The following discussion summarizes the major environmental concerns involved in the choice of an appropriate access corridor. This information is summarized in Tables 40 (Roads) and 41 (Rail).

6.6.1 Road Access Alternatives. All road access alternatives assumed a two-lane access from I-5 and overpasses at certain interchanges (Figure 58). Although none was defined with respect to exact location, design specifics, or costs, all alternative access routes were operationally feasible. It was assumed that mitigating measures to minimize impacts due to stormwater runoff and disruption of archaeological and other resources could be implemented for each alternative.

Several of the alternatives would use the Fort Lewis and DuPont interchanges along I-5. According to the State Highway Department, traffic impacts would be severe if trucks carrying logs and forest products were to use these interchanges, especially during peak traffic periods. Mount's Road interchange, however, is underutilized and can accommodate the projected truck traffic. Therefore, alternatives using the Mount's Road interchange are favored in terms of these traffic impacts.

The City of DuPont opposed the use of Barksdale Avenue (the main street in DuPont), since it passes through a quiet, single-family residential area. Use as a transportation corridor to the export facility would be accompanied by severe noise and traffic impacts.

Other possible access routes considered included site entries from the DuPont-Steilacoom Highway, located east of the site. These access routes, however, would require use of the DuPont or Fort Lewis interchanges, that are subject to periods of traffic congestion. Also, these access routes might be located near colonies of Aster curtus, a perennial flowering plant that is listed as threatened in Washington on the Washington Natural Heritage Program's list of endnagered, threatened, and sensitive vascular plants in Washington (WNHP, 1981). Careful siting of the access routes would minimize impacts on this plant.

Land use would be severely affected by some alternative approaches. The Fort Lewis Golf Course, west of the Village of DuPont, would be disrupted by several of the alternatives. Some would pass through the golf course, others would pass along its eastern boundary.

TABLE 40

ENVIRONMENTAL IMPACT COMPARISON: ROAD ACCESS ALTERNATIVES

	ALTERNATIVES							
	1	2	3	4	5	6	7	8*
NOISE	passes thru quiet residential area	avoids sensitive areas	avoids sensitive areas	close to quiet residential area	close to quiet residential area	avoids sensitive areas	avoids sensitive areas	avoids sensitive areas
TRAFFIC	uses congested interchange	closes two interchanges	increase DuPont traffic; close interchange	uses congested interchange	uses underutilized exchange	uses congested interchange	uses underutilized exchange	uses underutilized exchange
AESTHETICS	pases thru residential area	well screened	well screened	visible from residential area	well screened	visible from residential area	well screened	well screened
LAND USE	passes thru residential area and golf course	avoids town and golf course	avoids town and golf course	close to residential area	passes thru golf course	passes thru more of Fort Lewis Base	avoids town and golf course	avoids town and golf course
SINGLE ROAD/RAIL ACCESS POSSIBLE?	no multiple road access	yes - rail alt. 3	yes - rail alt. 3	yes - rail alt. 6	yes - rail alt. 5	none matches	yes - rail alt. 3	yes - rail alt. 3
FLORA	passes thru or near Aster curtus colonies	passes thru oak savannah habitat	passes thru oak savannah habitat	passes thru or near Aster curtus colonies	passses thru oak savannah habitat	passes thru or near Aster curtus colonies	passes thru oak savannah habitat	passes thru oak savannah habitat
FAUNA	avoids gray squirrel habitat	eliminates gray squirrel habitat	eliminates gray squirrel habitat	avoids gray squirrel habitat	may eliminate gray squirrel habitat	avoids gray squirrel habitat	eliminates gray squirrel habitat	eliminates gray squirrel habitat
WETLANDS/ AQUATIC HABITAT	avoids wetlands	crosses Sequalitchew Creek	crosses Sequalitchew Creek	avoids wetlands	crosses Sequalitchew Creek	passes near or thru Edmond Marsh	crosses Sequalitchew Creek	crosses Sequalitchew Creek

*Proposed Alternative

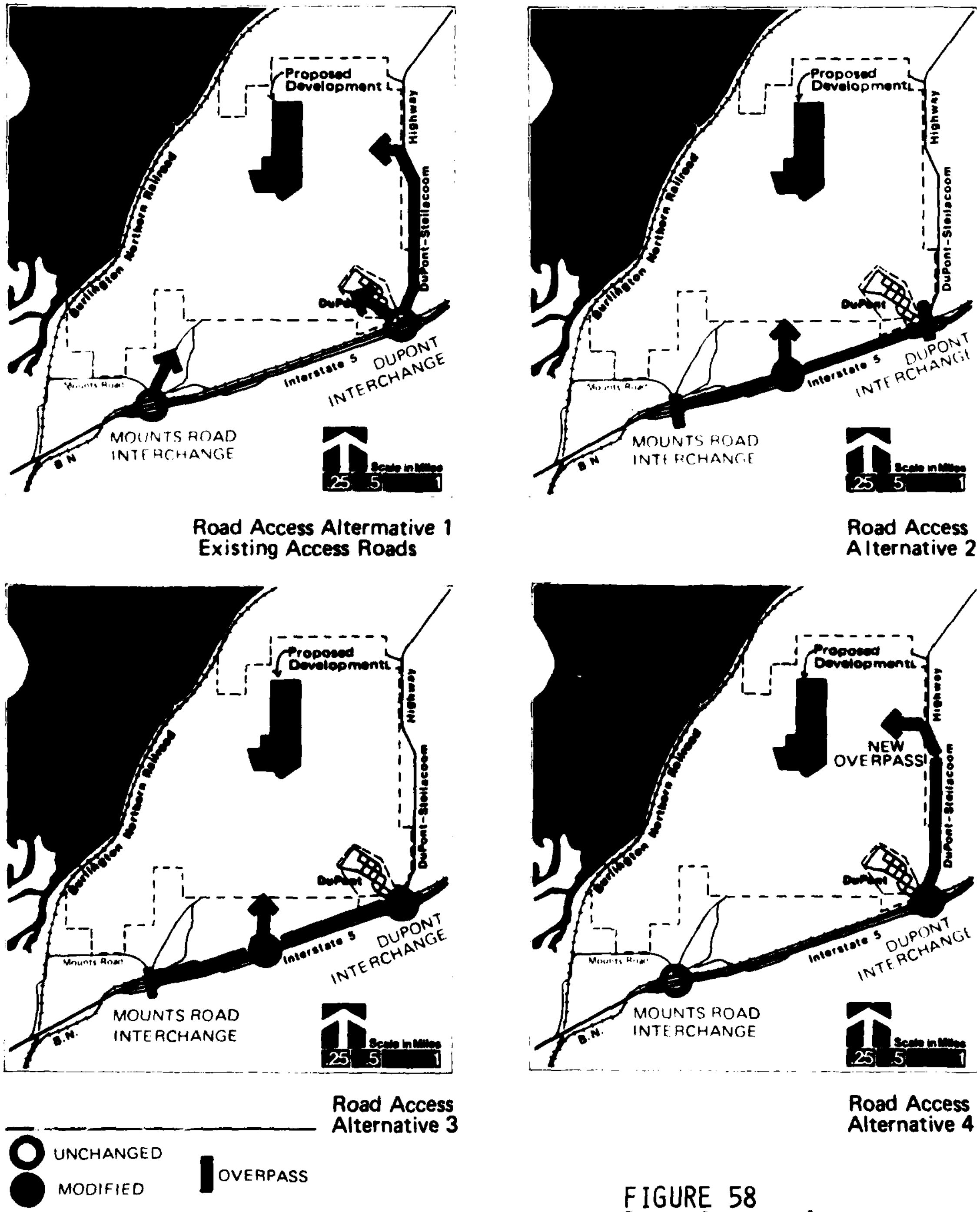
TABLE 41

ENVIRONMENTAL IMPACT COMPARISON: RAILROAD ACCESS ALTERNATIVES

ALTERNATIVES

	1	2	3*	4	5	6	7	8
EARTH	no problems	climbs bluff	no problems	no problems	no problems	no problems	climbs bluff and crosses creek	climbs bluff
NOISE	passes thru quiet residential area	hill climbing noise near refuge	avoids most sensitive areas	close to DuPont	passes thru golf course	close to Fort Lewis barracks	additional noise source for Anderson Island and refuge	additional noise source for Anderson Island and refuge
TRAFFIC	crosses major roads into DuPont & Steilacoom	no interference	no interference	crosses DuPont - Steilacoom Highway	crosses Mounts Roads	no interference	no interference	no interference
AESTHETICS	visible from DuPont	visible from refuge	well screened	close to DuPont	visible from golf course	visible from DuPont - Steilacoom Highway	visible from Anderson Island	visible from Anderson Island
LAND USE	passes thru residential area	route mostly within industrial zoning	route mostly within industrial zoning	cuts thru more of Fort Lewis	cuts thru golf course	cuts thru more of Fort Lewis	route mostly within industrial zoning	route mostly within industrial zoning
FLORA	passes thru or near oak savannah habitat	passes thru forestland	passes thru oak savannah habitat	passes thru dense timber and brush	passes thru or near oak savannah habitat	passes thru or near *Aster curtus* colonies	eliminates some Sequalitchew Creek habitat	eliminates some forestland
FAUNA	passes thru or near Edmond Marsh	noise disturbance to wildlife	eliminates gray squirrel habitat	disturbs wildlife of Edmond Marsh	may eliminate gray squirrel habitat	avoids gray squirrel habitat	disturbance to Sequalitchew Canyon wildlife habitat	avoids gray squirrel habitat
WETLANDS/ AQUATIC HABITAT	passes thru or near Edmond Marsh	passes near Old Fort lake; crosses Sequalitchew Creek	crosses Sequalitchew Creek	passes thru Edmond Marsh; crosses Sequalitchew Creek	crosses Sequalitchew Creek	avoids wetland/ creek crossings	crosses Sequalitchew Creek	avoids creek crossing

*Proposed Alternative



Road Access Altermative 1
Existing Access Roads

Road Access
Alternative 2

Road Access
Alternative 3

Road Access
Alternative 4

FIGURE 58
ROAD ACCESS ALTERNATIVES

FIGURE 58 (CONT)
ROAD ACCESS ALTERNATIVES

* Proposed

The southern approach to the site is associated with potential impacts on the Oak Savannah community located on the Weyerhaeuser-DuPont site. This community provides important habitat for the western gray squirrel, a species that is becoming increasingly rare in the Pacific Northwest. Also, a number of archaeological/historical resources are located to the south of the proposed development site along the routes of several alternative approaches. Careful route selection could minimize impacts on these important resources. These southern approaches would also cross the upper part of Sequalitchew Creek. Care during construction would be required to minimize effects on water quality in the creek. Despite these potential adverse impacts, alternatives using a southern approach and the Mount's Road interchange were favored because of more limiting impacts associated with other alternatives, as described above.

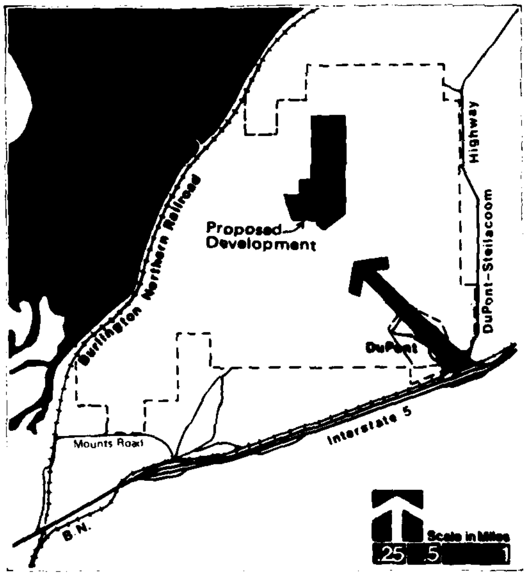
One alternative called for the construction of an interchange between the Mount's Road and DuPont interchanges. Federal policy, however, restricts the number of interchanges along a stretch of freeway such that no more than one interchange exists within any one mile of freeway. If a new interchange were approved between the two existing interchanges, the other two would have to be closed. Weyerhaeuser's preferred alternative, therefore, would be to modify the Mount's Road interchange and provide an overpass from a frontage road along the south side of I-5 to the export facility (Figure 58, Alternative 8).

6.6.2 Railroad Access Alternatives. All of the railroad access alternatives assumed spur lines from existing lines along the shoreline and adjacent to I-5 (Figure 59). The considered alternative designs were not refined relative to exact locations, design specifics, or costs.

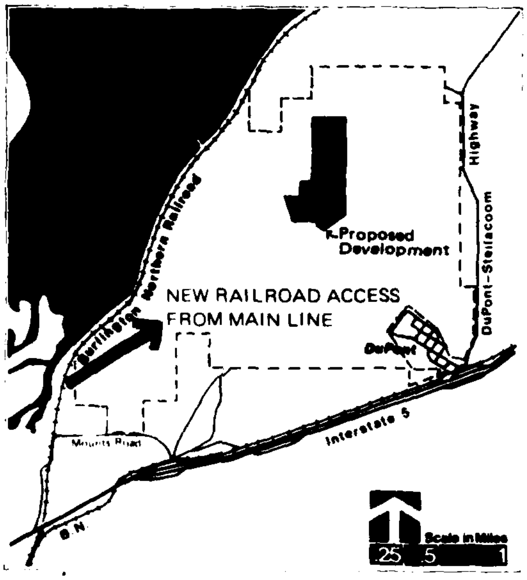
Topography is an important constraint on railway alternatives that would provide access from the shoreline. A steep bluff rises sharply approximately 200 feet from the waterfront. From an energy use standpoint, these "shoreline alternatives" would be inefficient, since cargo would be taken to the top of the bluff, stored, repackaged, and returned down the bluff to be loaded on a ship. Concern about the bluff's geology, soils, and seismic stability makes these alternatives environmentally less attractive than other alternatives, located on essentially level, stable ground.

For other railroad access alternatives, conflicts with aesthetic values, land uses, and flora and fauna are similar to those discussed in the previous section concerning road access alternatives.

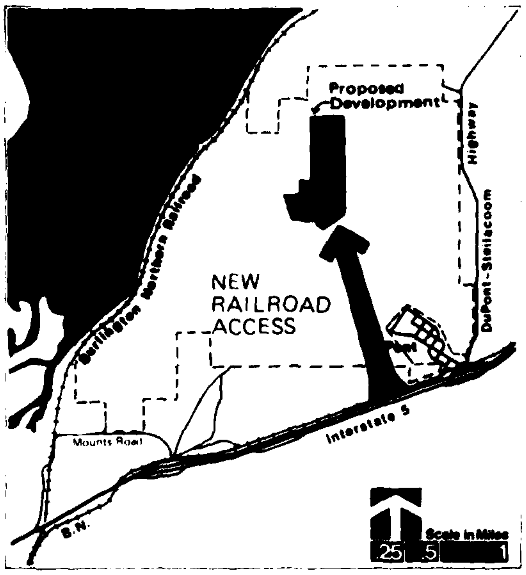
Incorporation of the roadway and railroad access line into one corridor is environmentally preferable to use of separate corridors because a reduced area would be disturbed due to combined traffic in this corridor. The proposed action is a combination of Road Access Alternative 8 (Figure 58) and Railroad Alternative 3 (Figure 59).



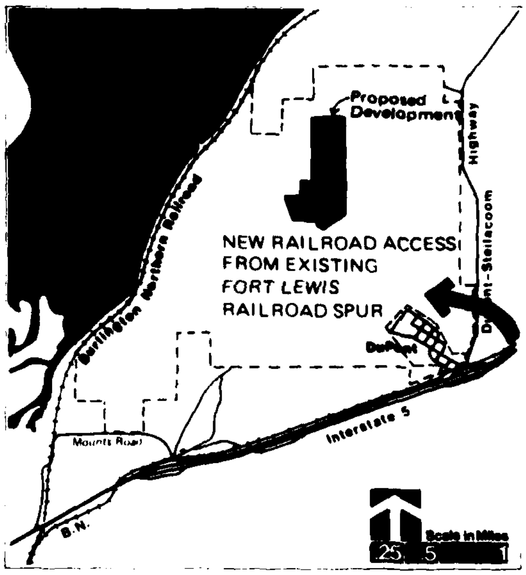
Railroad Access
Alternative 1



Railroad Access
Alternative 2



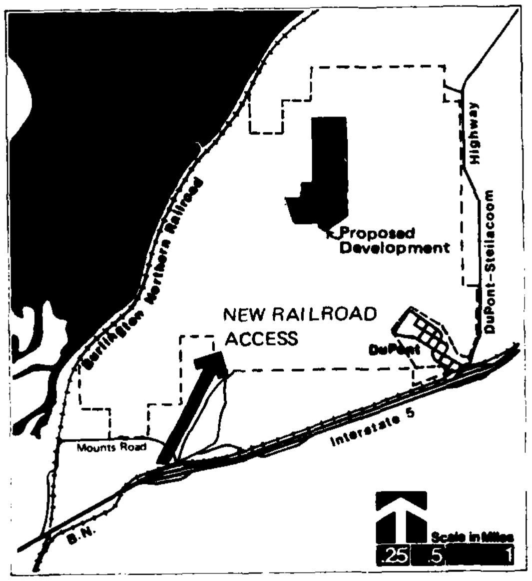
Railraod Access *
Alternative 3



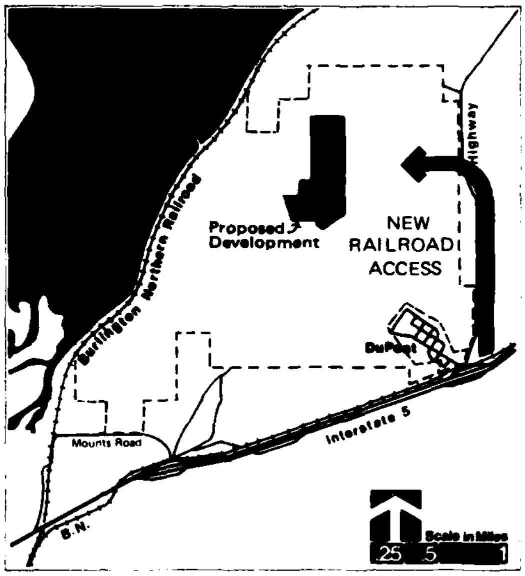
Railroad Access
Alternatvie 4

FIGURE 59
RAIL ACCESS ALTERNATIVES

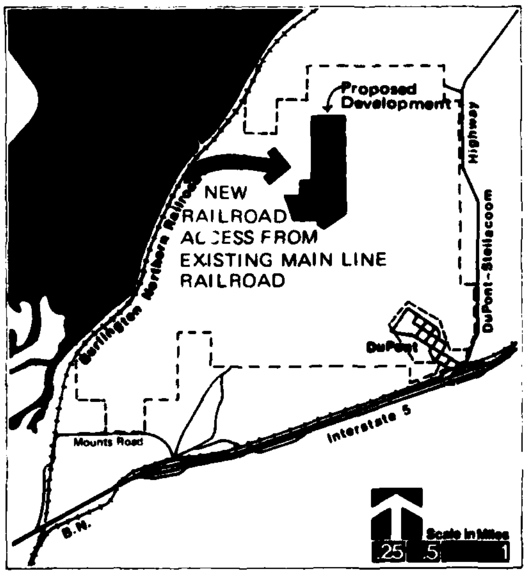
* Proposed



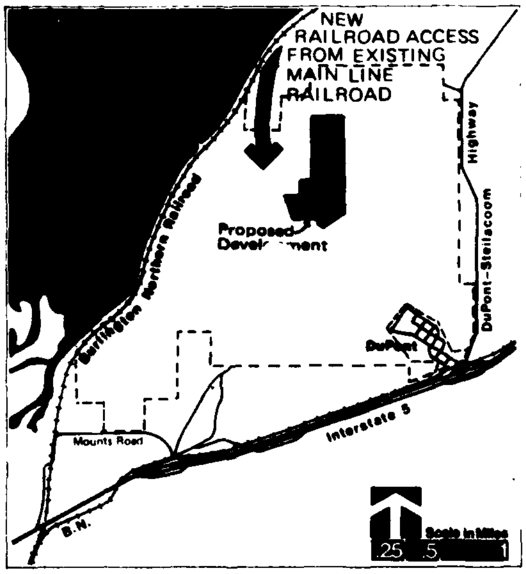
Railroad Access
Alternative 5



Railroad Access
Alternative 6



Railroad Access
Alternative 7



Railroad Access
Alternative 8

FIGURE 59 (CONT)
RAIL ACCESS ALTERNATIVES

6.7 ALTERNATIVE DESIGNS FOR THE PROPOSED EXPORT FACILITY AT DUPONT

6.7.1 Introduction

A design study by Weyerhaeuser developed alternative conceptual designs for the DuPont export facility. Design constraints on site use involved maximizing cost-effectiveness and minimizing environmental impact. Some specific constraints were: (1) all industrial development had to be north of Sequalitchew Creek; (2) the dock was to be no further south than the existing wharf (to avoid the sediments prone to liquefaction during earthquakes), but must be within the shoreline area zoned urban; and (3) there would be no fueling of vessels at DuPont.

Four engineering firms (Jaakko Poyry and Co.; D'Appolonia-Dravo; Parsons, Brinkkerhoff, Quade and Douglas, Inc.; and Frederick R. Harris, Inc.) were selected to develop alternative conceptual designs. Each firm developed numerous alternatives for each aspect of the proposed facility. Table 4, in Appendix N, lists all of the designs that were developed, evaluated and presented by these firms in their final reports. Each firm analyzed its alternatives, selected at least one for more detailed consideration, and finally selected one or two as its recommended design. Six recommended designs were submitted.

Each design deals with four separate components: (1) a terminal area on the upland portion of the site where material would be received, handled and stored; (2) a system to transport material from storage to the dock; (3) a dock; and (4) vessels to be used for exports.

A brief description of each design alternative follows. Environmental impact comparisons are presented in Tables 42 to 44.

6.7.2 Design Alternatives

The proposed project (Chapter 1) includes many features incorporated from these six design alternatives, but does not use any one of them in its entirety. (See Section 6.7.5 for a comparison of these design competition alternatives and the proposed action.)

6.7.2.1 Alternative 1. The site layout for Alternative 1 is shown in Figure 60. Products would be unloaded by forklifts and log stackers into a conventional storage area. For transfer to the dock, material would be loaded onto narrow gauge railroad cars and lowered by towline to the waterfront through a tunnel with a 24 per cent grade. The dock itself would be L-shaped, 900 feet long and 95 feet wide, and oriented almost parallel to the shore. Material would be lifted from the cars on the dock into an open hatch 47,000 DWT vessel by two shipboard cranes. A fleet of four ships would make a total of 38 trips per year.

6.7.2.2 Alternative 2. The central feature of this design (Figure 61) is a "boathouse" or underground loading and mooring yard enclosed within the bluff. This structure would be used for storage of water-sensitive products, as well as for transport and shiploading operations. Storage and receiving would otherwise be the same as for Alternative 1. Barges would enter at low tide through a channel under the railroad; dredging would be required for channel construction. Cranes would load products on the barge portion of the 41,000 DWT integrated tug-barge. One barge would be in the boathouse (at sea level) at all times. The fleet would include five tugs and six barges; 45 trips per year would be required. Only two turning dolphins and the movable screen would be visible from the waterfront.

6.7.2.3 Alternative 3. Figure 62 shows the site layout for this alternative. Cargo would be loaded onto lift unit frame (LUF) flats and moved by a rubber-wheeled tractor along a road with a five percent grade in the Sequalitchew Creek ravine to the pier. The road, which would be located on the north side of the ravine at times within 50 feet of the creek, would be constructed by the reinforced earth method. This method involves construction of a 30-foot deep foundation that acts as a built-in retaining wall; alternating layers of metallic reinforcing strips and select backfill are used to construct the foundation for about half the width of the road on the creek side. The dock would include a concrete deck (150 by 300 feet) and ramp for loading the four 43,000 DWT roll-on/roll-off ships (ships loaded by driving vehicles on and off). The ships would make 44 trips per year. Several dolphins (clusters of piles) connected by a 1000-foot long walkway parallel to the shore would be constructed for berthing and mooring.

6.7.2.4 Alternative 4. The site layout is shown in Figure 63. Material would be stored in specially designed storage areas by elevating transfer vehicles. Cargo would be loaded onto standard, metal-wheeled railroad flat cars for transfer to the dock via a covered railway cut into the bluff (40 per cent grade). A conveyor system would move cars down the bluff onto a loop-shaped dock oriented parallel to the shore. The dock would touch the shore at two places; it would be 1300 feet long and encompass a 10-acre area. Cargo would be loaded by shipboard cranes into a 66,000 DWT open hatch vessel. Three ships would make 27 trips per year.

6.7.2.5 Alternative 5. This alternative, shown in Figure 64 differs from the preceding one only in the terminal area, where storage and handling would be accomplished in 21 traveling gantry bays by 8 traveling gantry cranes. Each gantry bay would have 2 railroad spurs that would hold 50 cars each.

6.7.2.6 Alternative 6. The upland portion of this alternative shown in Figure 65 would include conventional handling and storage areas, and two large railroad switching areas. Cars would be loaded on rubber-tired tow cars that would descend the bluff to the pier through an elevated, fixed guideway (18 per cent slope). A conveyor system and hydraulic car pushers would move the cars onto the 840 foot by 120 foot dock that would extend perpendicular to the shore. Three dock-mounted cranes would transfer cargo into a 70,000 DWT open hatch vessel. Three ships would make 29 trips per year.

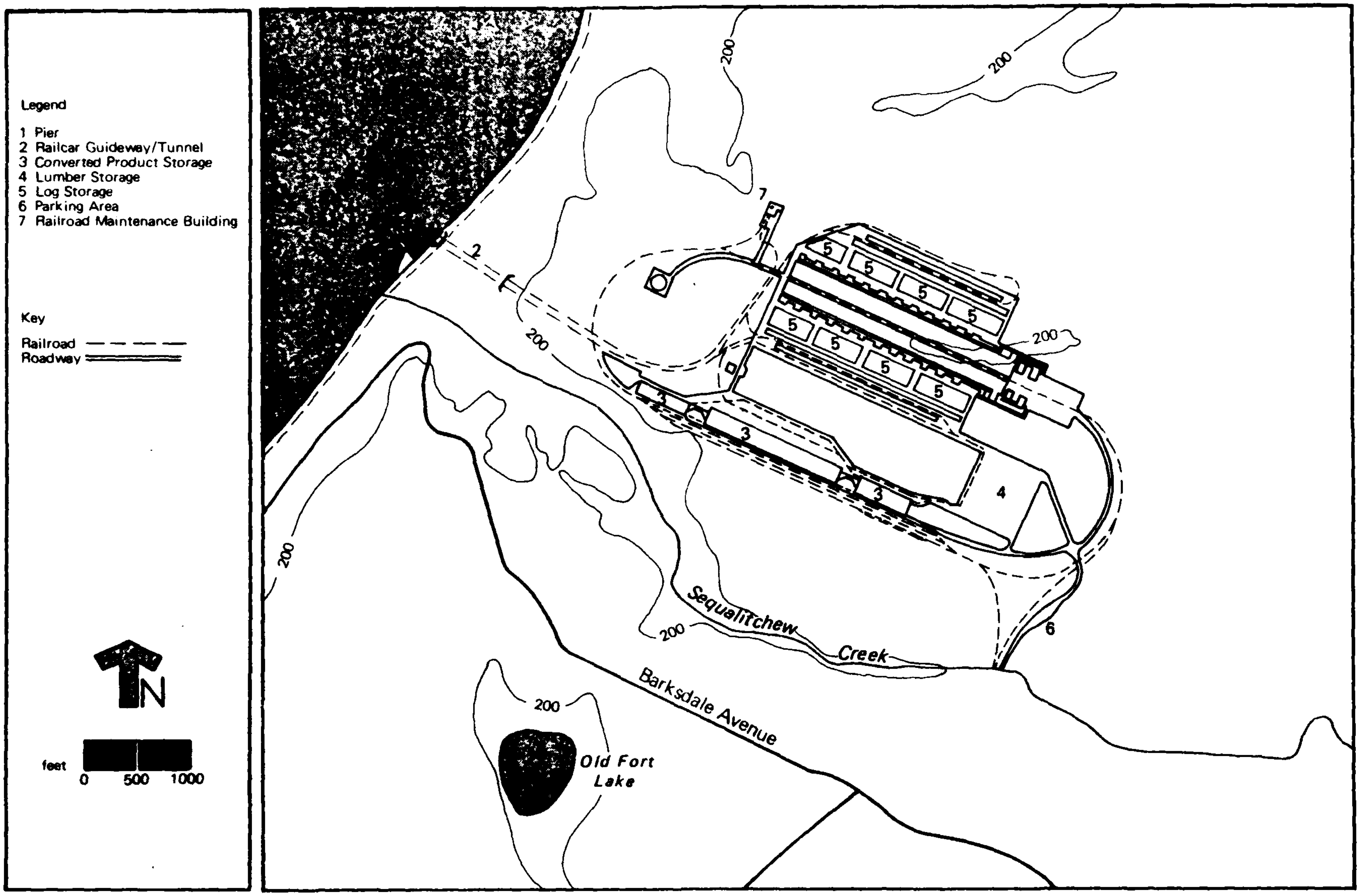


FIGURE 60
SITE DEVELOPMENT
ALTERNATIVE 1

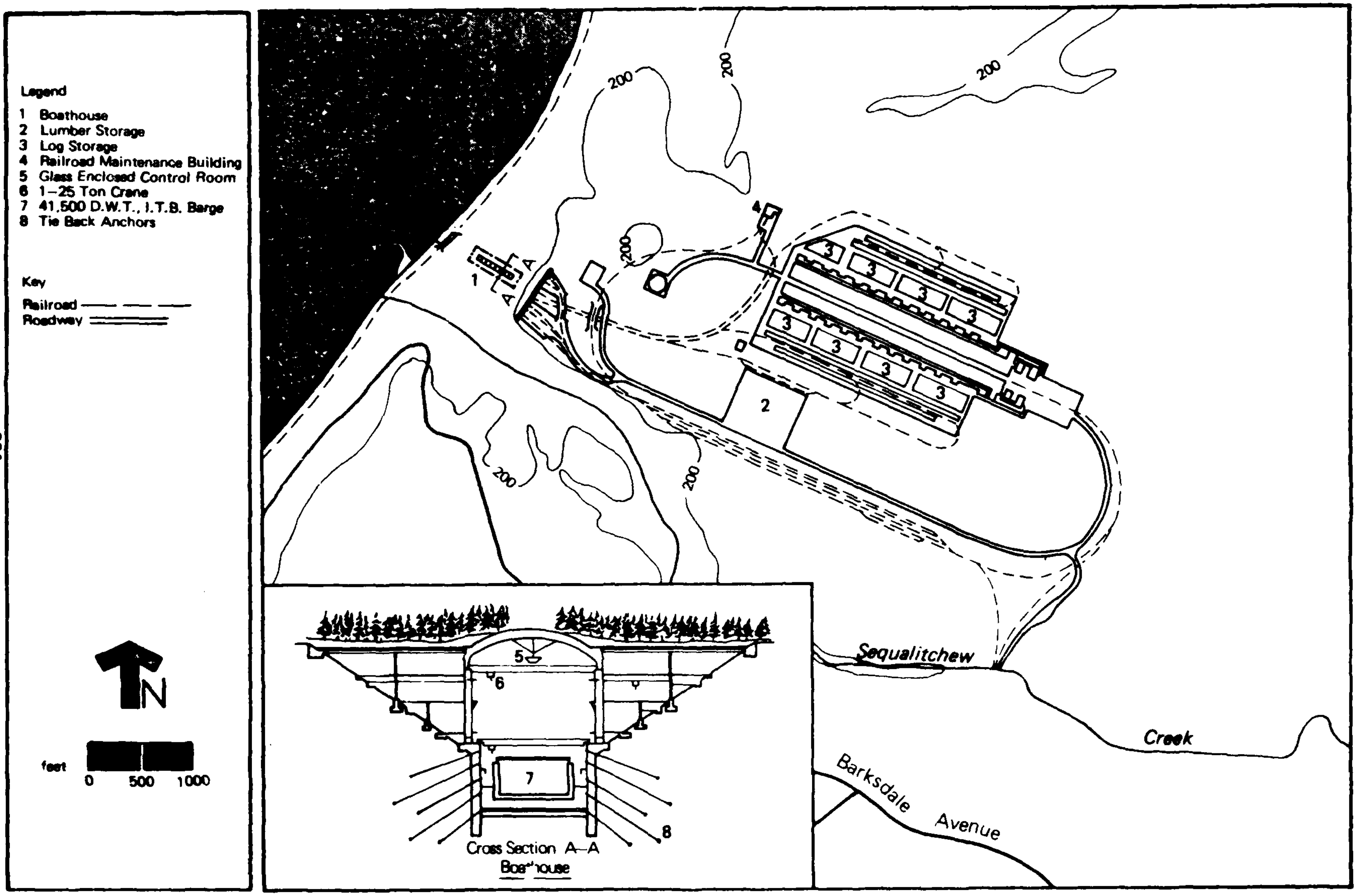
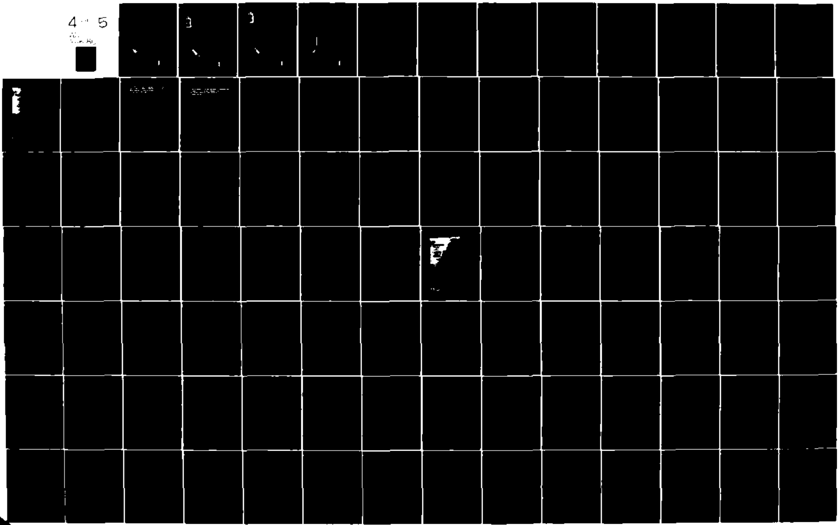
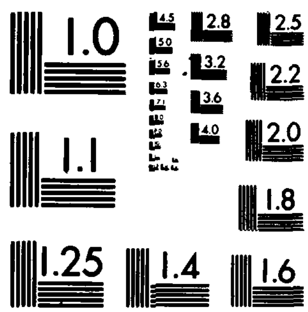


FIGURE 61
SITE DEVELOPMENT
ALTERNATIVE 2

AD-A116 180 URS CO SEATTLE WA F/G 13/2
WEYERHAEUSER EXPORT FACILITY AT DUPONT. VOLUME I.(U)
MAY 82

UNCLASSIFIED NL





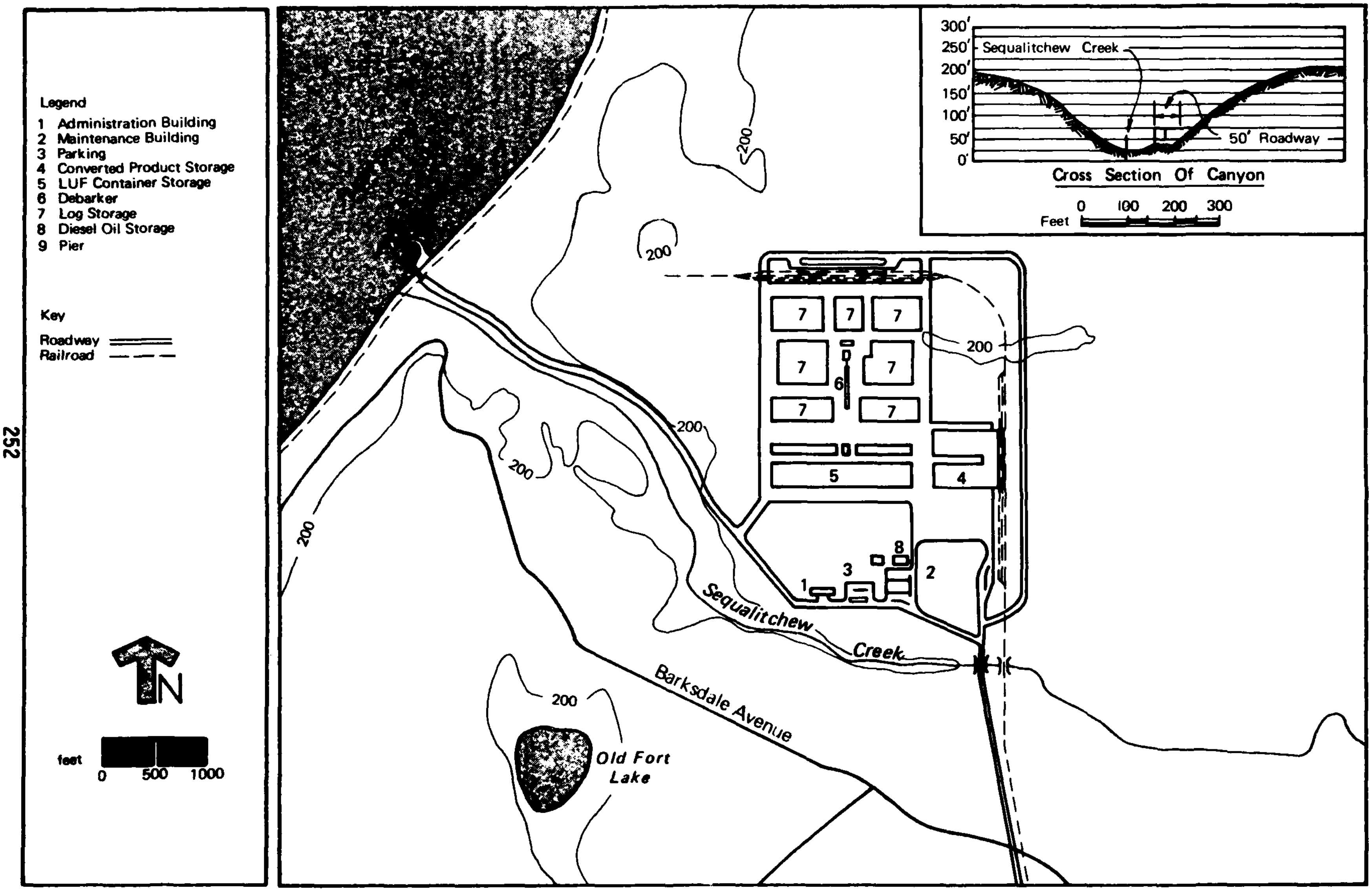


FIGURE 62
SITE DEVELOPMENT
ALTERNATIVE 3

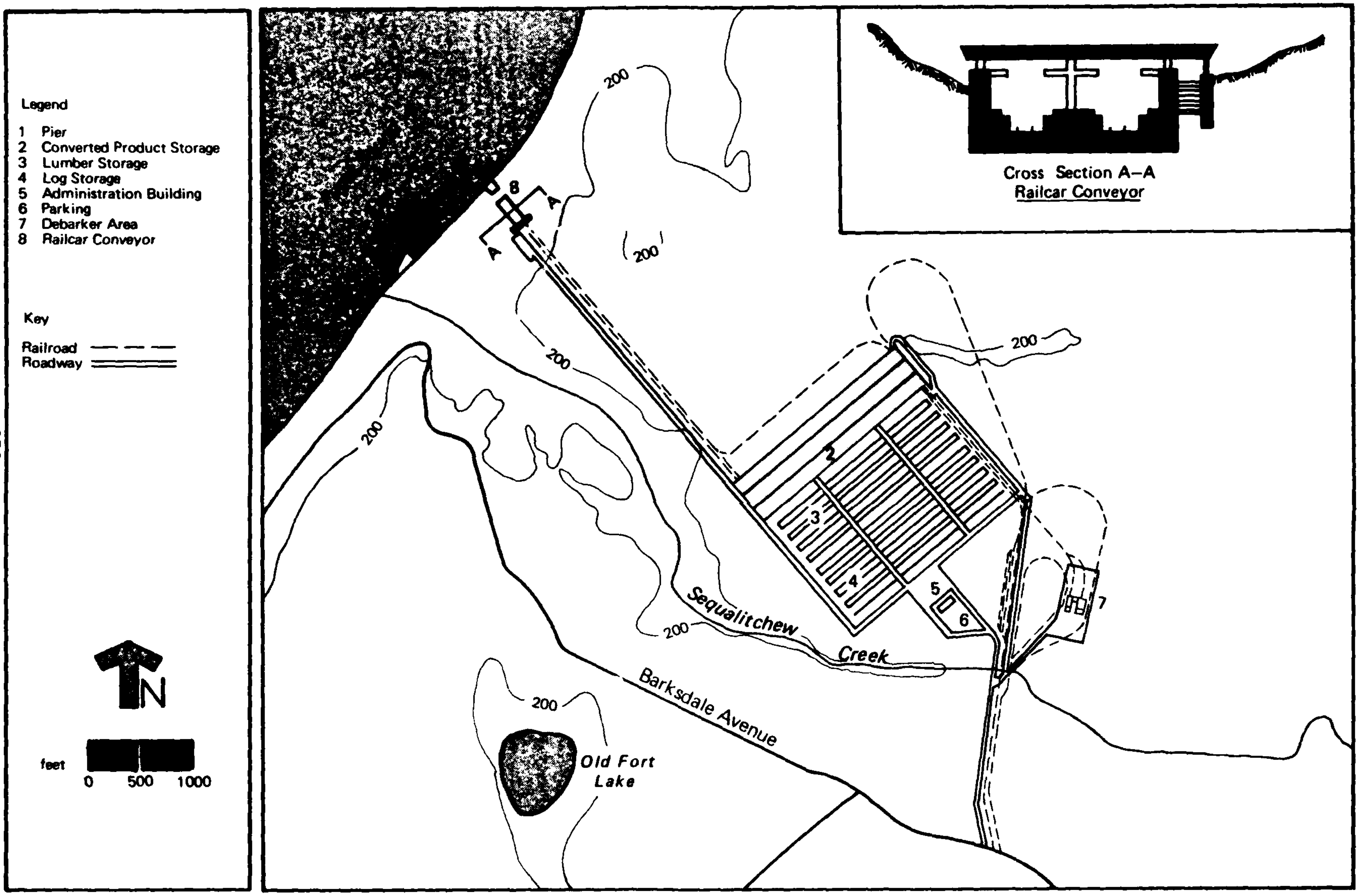


FIGURE 63
SITE DEVELOPMENT
ALTERNATIVE 4

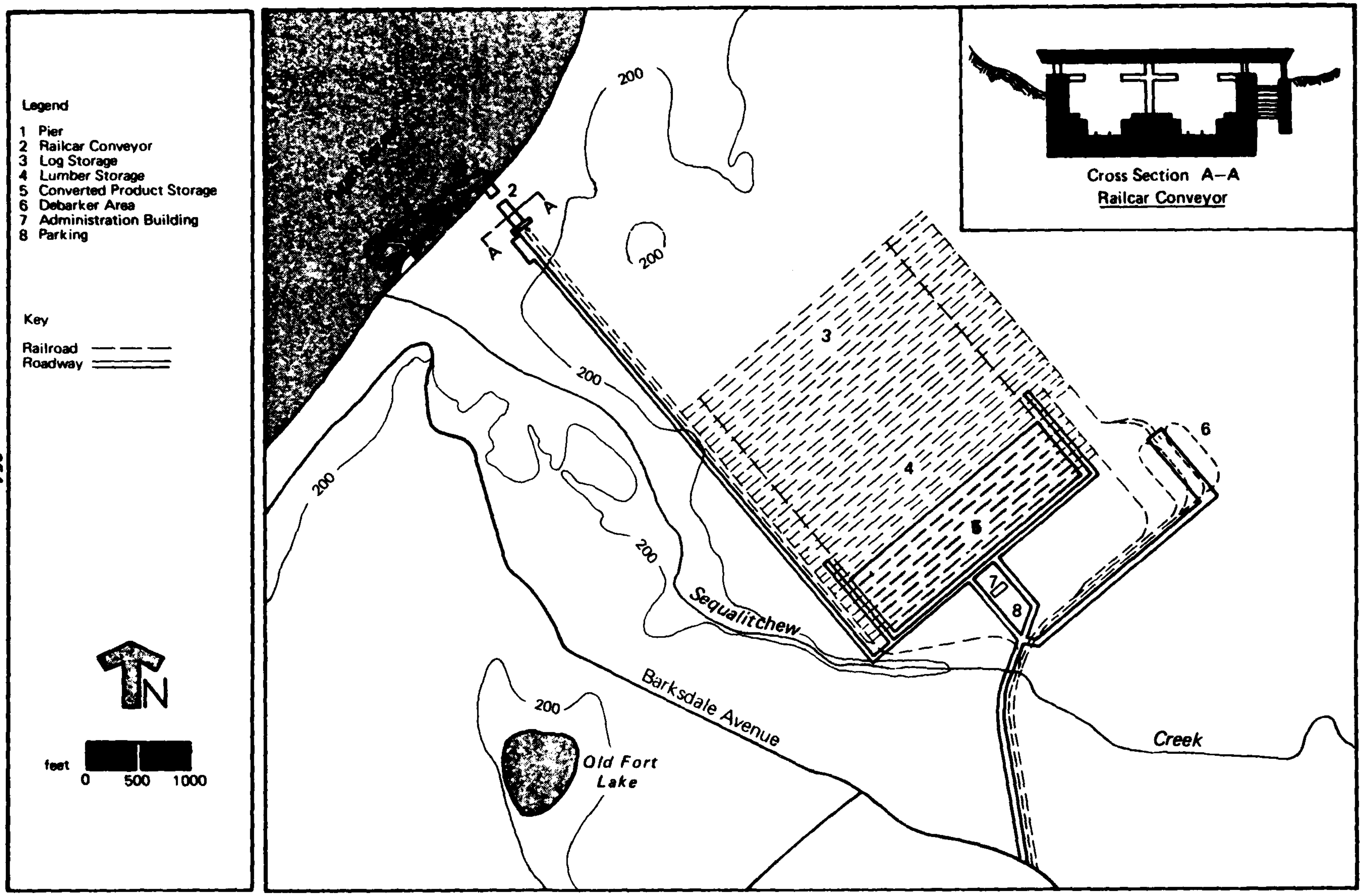


FIGURE 64
SITE DEVELOPMENT
ALTERNATIVE 5

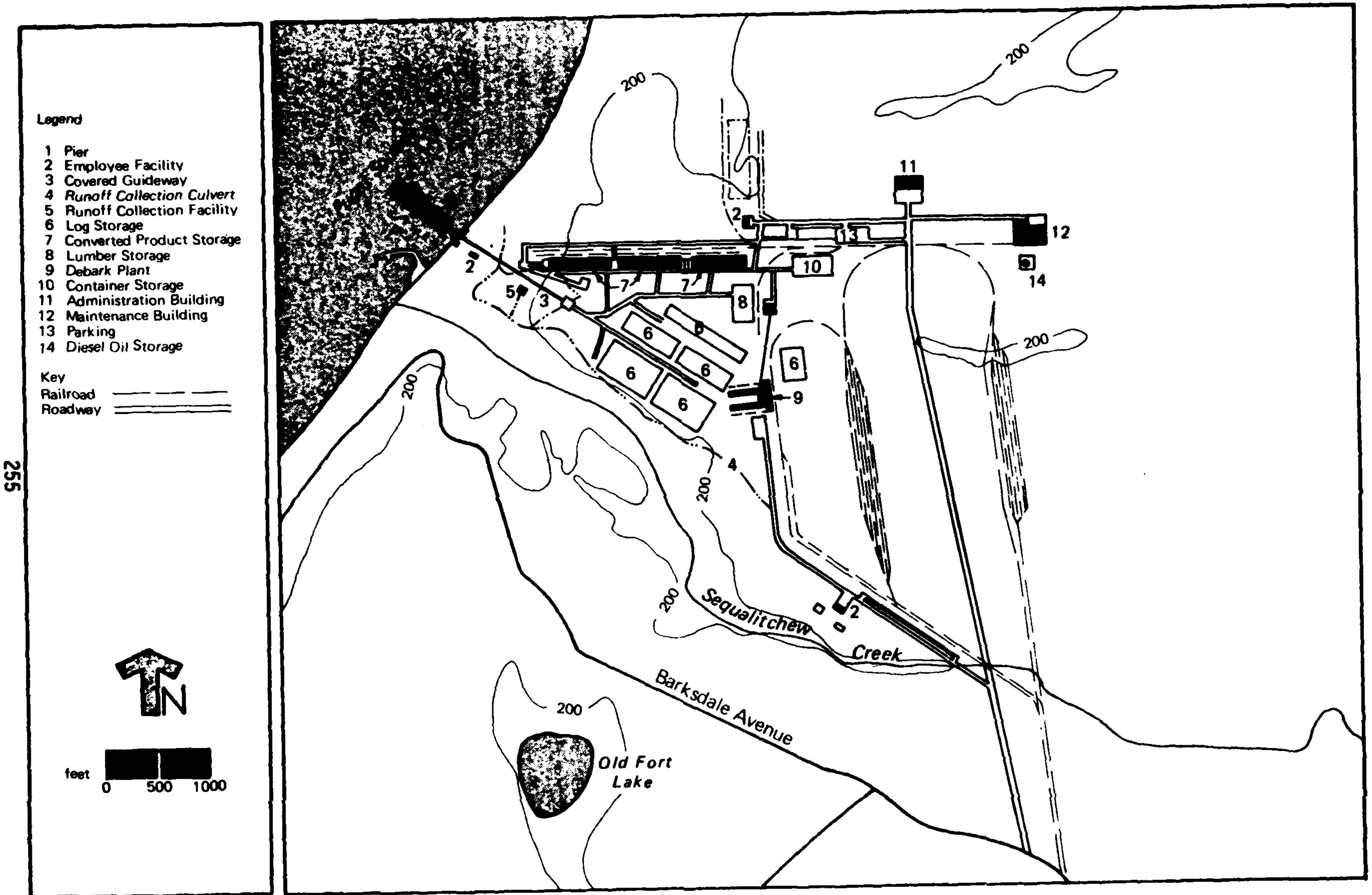


FIGURE 65
SITE DEVELOPMENT
ALTERNATIVE 6

6.7.3 Environmental Impact Comparison

6.7.3.1 Terminal. The major differences in environmental impact of these alternatives are summarized in Table 42, and described in more detail below. Information related to these factors is summarized in Table N-4 (Appendix N); since only conceptual designs were provided, information on some aspects is unavailable.

The total area is smallest for alternatives "1", "2" and "4"; each requires about 200 acres. Use of a smaller area would disrupt less resident flora and fauna and minimize loss of wildlife habitat. A larger buffer would be retained to avoid changing the general appearance of the site from off-site. Alternative "6" is the only alternative that would locate upland development so close to the bluff that (1) noise could not be adequately buffered (to prevent upland noise from reaching Nisqually Reach and Anderson Island) and (2) the bluff could also possibly destabilize.

All alternatives are closer to Sequalitchew Creek than to the bluff. The terminal area of Alternative "5" is only 110 feet from the creek at the closest point; that of Alternative "1" is the farthest removed (380 feet). Cultural resources would probably be affected by alternatives "3", "4", and "5"; however, with use of mitigating measures, impacts would be minor. Topographic changes (principally related to disposal of earth removed to construct the transport system) would be significant for Alternatives "2", "4", and "5". Alternatives "1" and "3" would probably also involve considerable topographic change in the upland area; however, details are not available. Dewatering required during construction of the "boathouse" (Alternative "2") would cause changes in local groundwater flow patterns. Construction of impervious surfaces (buildings, roads, paved areas) also results in local changes in groundwater infiltration and flow. In both cases, the effect on groundwater would be minor in relation to the amount of groundwater in the region. Increased storm water runoff due to addition of impervious area might be a more serious problem, depending on how it was handled. Drainage adequate to accommodate anticipated flows would be required; treatment to remove pollutants such as oil and grease, tannins, lignins, fungicides, cadmium, lead, and asbestos would prevent degradation of the receiving water. These problems would be mitigated by use of permeable surfacing such as gravel or porous pavement; however, this would increase the risk of groundwater quality degradation. Furthermore, substantial vehicular traffic over unpaved areas might result in high levels of fugitive dust emissions, thus creating an air quality problem. Both air quality and groundwater quantity and quality considerations could be satisfied by use of paved storage areas and roads and effective treatment of runoff followed by groundwater recharge.

This analysis indicates no clear preference of one alternative over another except that Alternative "6" should be avoided because it requires excessive area (430 Ac) and is located too close to the bluff. Alternatives "1", "2", and "4" would disrupt the smallest area (200 acres each).

TABLE 42

ENVIRONMENTAL IMPACT COMPARISON: TERMINAL ALTERNATIVES

	ALTERNATIVES						
	1	2	3	4	5	6	Proposed
EARTH	much topographic change	major topographic change	much topographic change	much topographic change	major topographic change	little topographic change, but may destabilize bluff	little topographic change, but may destabilize bluff
WATER	outfall treated effluent to sound	outfall treated effluent to sound	no outfall infiltration of runoff	no outfall infiltration of runoff	no outfall infiltration of runoff	outfall treated effluent to sound	no outfall infiltration or runoff
FLORA/ FAUNA	smallest area (200 Ac)	smallest area (200 Ac)	larger area (275 Ac)	smallest area (200 Ac)	larger area (340 Ac)	largest area (430 Ac)	smallest area (200 Ac)
NOISE	narrow buffer	moderately well screened	moderately well screened	furthest from bluff	moderately well screened	closest to bluff	moderately well screened

6.7.3.2 Transport System. The major differences in environmental impacts of the alternatives for transporting cargo from the terminal area to the dock are summarized in Table 43, and discussed below. Alternatives "7" to "10" (shown in Table 43) are described and discussed in Section 6.7.4 below. Table N-5 summarizes available information related to these impacts. Construction impacts are discussed subsequently.

The road required by Alternative "3" would have substantial impact on the Sequalitchew Creek ravine. Traffic through the ravine would disrupt habitat for terrestrial fauna in the area and create a continuing potential for water quality degradation. The road itself might block movement of shallow subsurface groundwater. Use of the existing narrow gauge railroad in the Sequalitchew Creek ravine, as required by Alternative "6", to transport workers and visitors to the dock would have some of the same impacts, although potential for disruption is less since traffic volume would be much less. The road required by Alternative "3" would also increase potential for landslides in the ravine.

Effects on topography, geology, and soils also varies. Alternatives "2", "4", "5", and "6" could destabilize the bluff. Substantial reduction in grade near the entrance to the covered railway near the top of the bluff would be required by Alternatives "4" and "5". Little or no grading would be required near the entrance to the top of the tunnel in Alternative "1". Although extensive excavation and grading at the edge of the bluff would be required for construction of the "boathouse" in Alternative "2", once the boathouse was complete, no surface structures or downgrading of the bluff would remain.

Those alternatives in which the access route is aboveground, but not elevated, would block movements of animals within their territories. The reinforced earth road through the Sequalitchew Creek ravine (Alternative "3") incorporates a 30-foot retaining wall that would act as a significant barrier. The covered railway down the bluff in Alternatives "4" and "5" would form a barrier to animal movement as well. This impact could be substantially mitigated by placing the railway completely underground. Animals could cross beneath the covered guideway in Alternative "6" and Alternatives "1" and "2" would not impede animal movement.

Alternatives involving structures totally or partially underground would change groundwater flow patterns. Groundwater movement near the bluff would be affected by alternatives "1", "2", "4" and "5"; movement near Sequalitchew Creek would be affected by alternative "3".

Noise and aesthetic impacts (including light and glare) would be minor for those alternatives in which the transportation system is underground (Alternatives "1" and "2"). Alternative "3" would involve noise and aesthetic impacts within the Sequalitchew Creek ravine; some of this impact would be buffered from off-site observers by vegetation. The guideway employed by Alternatives "4" and "5" would probably cause the most severe off-site noise impacts because metal-wheeled vehicles would be used and the

TABLE 43

ENVIRONMENTAL IMPACT COMPARISON: TRANSPORT SYSTEM

ALTERNATIVES

	1	2	3	4/5	6	7	8	9	Proposed
EARTH	substantial excavation to bluff	extensive excavation; may destabilize bluff	considerable change in creek canyon	local change in grade at top of bluff	substantial disturbance of bluff	major cut and fill on bluff	major cut fill on bluff	substantial disturbance of bluff	considerable change in creek canyon
WATER	minimal impact	change in local groundwater flow patterns	potential for contamination of creek; road runoff enters Sound	minimal impact	minimal impact	road runoff enters Sound	minimal impact	minimal impact	potential for contamination of creek; road runoff enters Sound
FLORA/ FAUNA	no effect on animal movement	no effect on animal movement	destruction/ disruption of creek canyon and movement barrier	barrier to animal movement on bluff	some disruption of creek canyon habitat	disruption of animal movement on bluff	no effect on animal movement	no effect on animal movement	destruction/ disruption of creek canyon and movement barrier
NOISE	minor	minor	rubber-tired vehicles in canyon	metal-wheeled vehicles	rubber-tired ton carts above bluff	rubber-tired vehicles on bluff	minor	minor	rubber-tired vehicles in canyon
AESTHETICS	minor after revegetation	minor after revegetation	reinforced earth road in canyon	covered roadway on bluff	elevated guideway on bluff	cut and fill roadway on bluff	covered roadway on bluff	minor after revegetation	reinforced earth road in canyon

slope is very steep. Noise from rubber-tired tow carts on the guideway in Alternative "6" would be minor. The impact of the elevated guideway on the aesthetics of the site would be marked; the covered guideway used in Alternatives "4" and "5" would have a moderately adverse impact on aesthetics.

All alternatives, except Alternative "3", apparently use some of the potential energy of the cargo for cargo transport from the upland terminal to the dock. Sufficient data for comparison of the relative efficiency of use of this energy by each alternative is not available.

Construction impacts for all of the transport alternatives would be more severe than the operational impacts. Construction impacts would be particularly serious for Alternative "2", which requires movement of 1,500,000 cubic yards of earth. Noise from heavy machinery would significantly impact nearby wildlife. The duration of this impact would increase with the amount of excavation required; hence, noise impacts would be greatest for Alternative "2". Significant noise would also result from placement of sheet piling for alternatives using the open braced cut method of tunnel construction (Alternatives "2", "4", "5" and some of the tunnel in Alternative "1"). Although less earth would be moved, construction of the tunnels, road, or guideway required by the other alternatives would require substantial activity on the face of the bluff or on the side of the Sequalitchew Creek ravine. Such activity would tend to destabilize the bank and cause erosion and siltation into Puget Sound and Sequalitchew Creek. Since much of the tunnel in Alternative "1" would be constructed by tunneling methods, relatively little activity on the bluff would be required. Construction of the "boathouse" (Alternative "2") would require substantial activity near the top of the bluff, possibly destabilizing a portion of the bluff. Appropriate engineering techniques might be able to mitigate problems with bank stability, erosion and siltation. During construction, adverse aesthetic impacts would be moderate for Alternatives "1", "2", and "3" and signficant for Alternatives "4", "5" and "6".

Overall comparison of the transport alternatives indicates that serious environmental impacts would result from operation of any of the alternatives except "1" and "2". Although Alternative "2" would probably have the least impact once it was operational, construction impacts would be much greater than for any other alternative. Construction impacts would be significant for any of the alternatives.

6.7.4.3 Dock. The major differences in environmental impact of the dock alternatives are shown in Table 44. Data related to impacts are presented in Table N-6 (Appendix N).

Pier location determines its seismic hazard; sediments in areas to the south and west of the seaward extension of Sequalitchew Creek consist of loose material likely to liquify during an earthquake (Hart/Crowser, 1976). If the "Urban" shoreline designation is not moved northward, the dock for Alternatives "4" and "5" would extend into the area subject to liquefaction.

TABLE 44

ENVIRONMENTAL IMPACT COMPARISON: DOCK AND SHIPPING ALTERNATIVES

ALTERNATIVES

	1	2	3	4/5	6	Northern Alternative Dock	Proposed Dock
EARTH	lowest impacts	construction dredging	lowest impacts	higher seismic hazards	lowest impacts	lowest impacts	higher seismic hazards
WATER	no special spill protection	spills isolated within boathouse	no special spill protection	no special spill protection	dock perpendicular to shore-quicker dispersion of spills likely	boom around dock	boom around dock
FLORA/ FAUNA	large area shaded	no pier	smallest pier	large area shaded; occupies most intertidal area	large pier	largest area shaded	largest area shaded
INDIAN FISHERIES	dock extends away from milling area	least interference - no pier	dock extends into milling area	dock extends away from milling area	dock extends away from milling area	dock extends into milling area	dock occupies less of milling area
RISK	intermediate number of port calls	lowest speeds; intermediate number of port calls	intermediate number of port calls	fewest port calls	fewest port calls	most port calls	most port calls
NOISE	rubber-tired tractor	none	LUF tractors	metal rail cars, side arm tractor	rubber wheeled tow carts	log trucks, diesel stackers	log trucks, diesel stackers
LAND USE	dock in urban window	no dock	dock in urban window	shoreline plan change needed	dock in urban window	shoreline plan change needed	dock in designated urban area
AESTHETICS	small dock, parallel shore	no dock	larger dock, walkway parallel shore	large dock, parallel shore	large dock with cranes, perpendicular to shore	large dock, parallel shore	large dock, parallel shore

Potential for water quality degradation would vary with the type of vehicles operating on the dock, orientation of the pier, and need for fueling near or on the dock. These impacts are minimized by Alternative "2", in which the shiploading operations are carried out inside an enclosed area. Any spills could be cleaned up before opening the screen. Of the other alternatives, only "6" has dock mounted cranes (which would require refueling on the dock itself). The remaining alternatives require rubber-tired tractors that would operate only in the vicinity of the dock, hence requiring refueling near the water. Oil, grease, and trace contaminants deposited by these vehicles and by the train cars used in Alternatives "1", "4", and "5" on the dock would be washed into the water by stormwater unless an adequate collection and treatment system were used. The pier in Alternative "6" is perpendicular to the shore, which might result in greater dispersion of contaminants compared to the other alternatives. However, this orientation would probably be the least favorable for successful docking or moorage during storms, possibly increasing the risk of accidental release of fuel or cargo.

Construction-related impacts would be significant for any of the alternatives. Alternative "2" would require less pile driving; however, 1.5 acres would have to be dredged. Each of the other alternatives would require substantial pile driving activity, but no dredging. Construction access from the water is proposed for all alternatives except Alternative "3" (although this dock could also be built from the water). The dock for Alternative "6" would be floated into position.

Operational impacts would be least for Alternative "2". No shiploading noise or interference with salmonid migrations or sediment movement would occur. The designers expect no need for operational dredging. All other alternatives have some potential for disruption of salmonid migration, although probably little more than that of the existing wharf. The loop-shaped dock required by Alternatives "4" and "5" would disturb more intertidal area than the other alternatives since it would connect with the shoreline twice (Figures 66 and 67). Activity and noise levels disruptive to wildlife would be generated by shiploading activities in all cases except with Alternative "2".

Aesthetic impacts would vary. Alternative "6", with its 840 by 120 foot dock and three large cranes would have the greatest impact. Docks required for "3", "4" or "5" would have a moderate impact. The former (Alternative "3") would include a large concrete dock (150 by 300 feet) perpendicular to the shore and a long narrow walkway parallel to the shore; the latter (Alternatives "4" and "5") would include a 1,300 foot long loop-shaped structure almost parallel to the shore. Barges could be moored along the north side of the pier, further degrading shoreline appearance. Alternative "1" would have the least impact consisting of a low profile, 900 foot long, L-shaped dock.

To summarize, the Alternative "2" dock would have the least environmental impact during dock operation provided that continued dredging is not required. The remaining dock alternatives vary principally in aesthetic impact, with Alternatives "1" and "3" expected to have the least aesthetic impact and Alternative "6" the highest aesthetic impact.

6.7.4.4 Shipping. The six alternatives vary in requirements for number of vessel trips per year and vessel size, which affect maneuverability and wake. These factors are shown in Table N-7 (Appendix N). A comparison of environmental impacts of the shipping alternatives is included in Table 44.

Fewer trips are required by Alternatives "3", "4", "5", and "6" than by Alternatives "1", and "2". Wake would not be a problem from any of these ships particularly at the low speeds at which they would approach the dock. Alternatives "1", "2", and "3" call for lighter vessels which would be easier to maneuver. Alternatives "4", "5" or "6" would be preferable in minimizing the number of vessel trips.

6.7.4.5 Number of Employees. An additional important factor is number of employees needed. Alternatives "1" and "2" would require the largest work force - more than 200. Alternative 3 would require 166 workers, while the number that would be required by Alternatives "4" or "5" is not known.

6.7.4 Weyerhaeuser Alternatives For Dock Access

After analyzing the conceptual designs developed in the design competition, Weyerhaeuser examined four dock access road alternatives. They are shown on Figure 66 and are numbered, for convenience, Alternatives 7 through 10. These included a reinforced earth road through Sequalitchew Creek Canyon (Alternative 10), a conventional road through an open cut on the northern portion of the site (Alternative 7), a road that descends the bluff in a tunnel on the northern portion of the site (Alternative 8), and a road/inclined elevator system (Alternative 9). Log and product trucks of the type currently in use would be used.

Either of the northern roads ("7" or "8") would require extensive disturbance of the face of the bluff, resulting in substantial erosion and possible destabilization of the bluff. Millions of cubic yards of earth would have to be removed and deposited somewhere on the upland portion of the site. Acquisition of land from Fort Lewis would also be required. The inclined elevator system ("9") would also disturb the bluff face, although much less excavation would be required than for the two northern roads. The elevator system would lack flexibility for changes in material handling systems (e.g., use of heavier vehicles).

Relative costs vary significantly. The cost of the road through the creek canyon (Alternative 10) and of the road through an open cut (Alternative 7) would be comparatively low. The road plus elevator combination (Alternative 9) would be expensive. The alternative requiring a tunnel (Alternative 8) would be several times more expensive than the low cost alternatives (7 and 10).

Overall, evaluation of costs, environmental impacts, flexibility, and property acquisition requirements led Weyerhaeuser to selection of a road through Sequalitchew Creek Canyon as the proposed action.

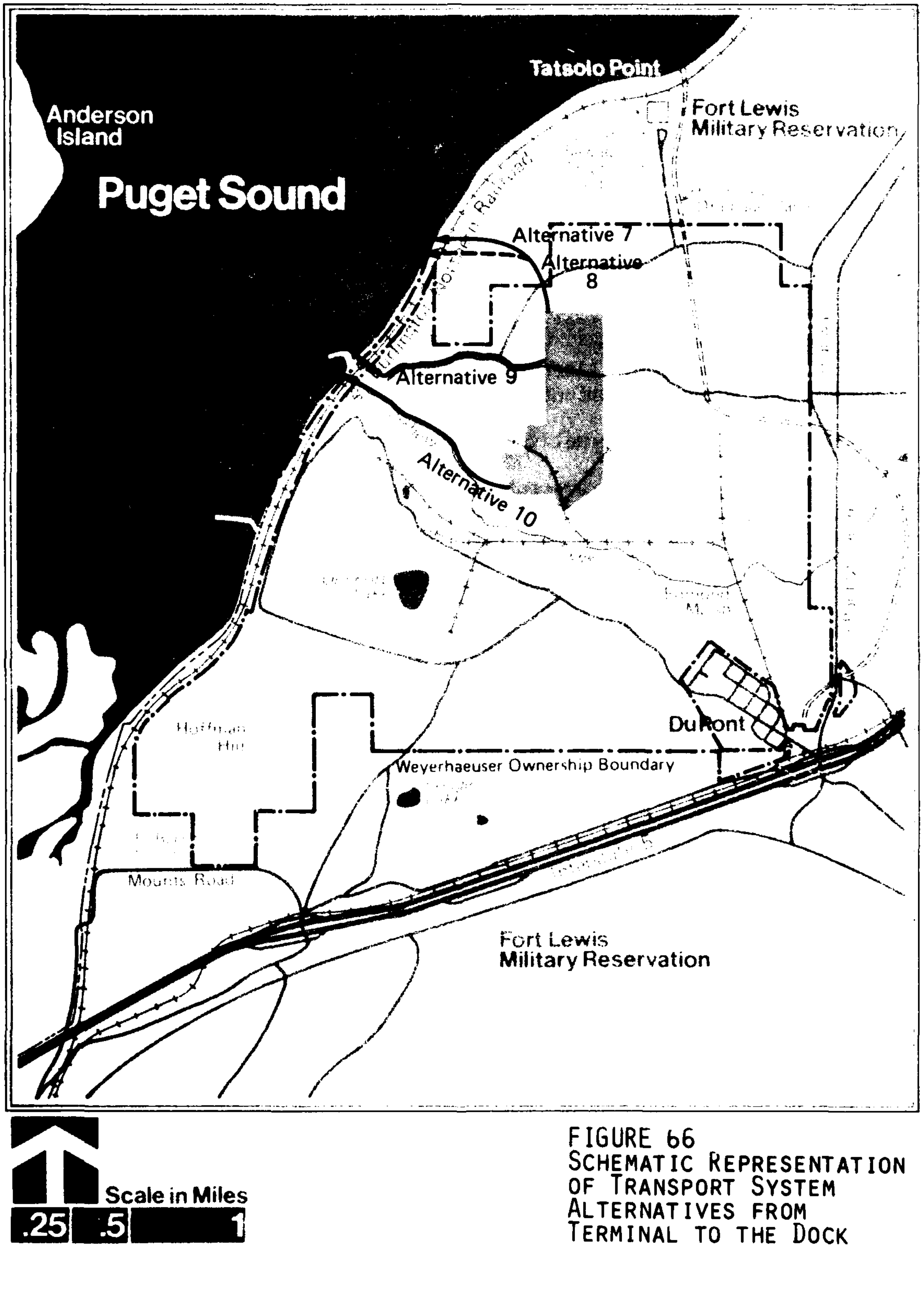


FIGURE 66
SCHEMATIC REPRESENTATION OF TRANSPORT SYSTEM ALTERNATIVES FROM TERMINAL TO THE DOCK

6.7.5 Comparison of the Proposed Action and the Design Competition Alternatives

Many features from the six conceptual design alternatives were incorporated into the plan for the proposed export facility. The proposed project most strongly resembles Alternative "3". Common features include conventional product handling and storage in the terminal area, use of a reinforced earth road along the north side of Sequalitchew Creek to provide dock access, and use of a dock adaptable to use by Roll-on-Roll-off (Ro-Ro) vessels. Although the proposed dock location is slightly farther north, the dock would have the features described in Alternative "3" for an alternative dock design capable of lift-on-lift-off loading in addition to Ro-Ro loading. Features allowing the proposed dock to serve Ro-Ro vessels would be a future modification rather than an initial characteristic of the proposed dock. One feature incorporated from Alternative "1" was a low profile for the proposed dock. Most of the design alternatives included dock construction from the water; this method is proposed for the project.

Analysis of the impacts of the proposed action is included in Tables 42 to 44 above.

7.0 The Relationship between Local Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed export facility involves trade-offs between long-term productivity and short-term uses of the environment.

The long-term biological productivity of the upland facility site (i.e., the quantity and diversity of natural vegetation and wildlife that it would support) would be reduced. The amount of habitat paved or seriously disturbed by the proposed project would be 245 acres (including 169 acres that would be cleared and 42 acres that would be encompassed within developed areas or otherwise seriously affected). Productivity of wetlands on the site (Edmond Marsh, Old Fort Lake, Sequalitchew Creek) would not be affected.

Unless a major spill occurred, low level discharges of hydrocarbons and heavy metals in treated stormwater runoff would not measurably decrease the productivity of marine organisms in the dock vicinity. Chronic low-level discharges into Nisqually Reach would not be expected to result in significant decreases in long-term biological productivity. Productivity of benthic invertebrate populations would not change significantly in the immediate area due to normal operations.

If a major spill were to occur (an event considered unlikely in view of risk calculations), significant impact on Nisqually Reach productivity would occur. Similarly, a major spill would decrease long-term productivity in the Nisqually Delta. Many valuable biological functions, including the provision of feeding, wintering, resting, and nesting habitat for migratory birds and a rearing habitat for salmon and marine fish would be impaired.

The proposed facility would increase the short- and long-term economic productivity of DuPont and the surrounding vicinity. Minor increases in regional employment and income would result from construction and operation of the facility.

The presence of an export facility capable of efficiently handling large volumes of forest products could increase potential markets and increase or at least sustain the output of the regional forest-products industry despite declines in traditional domestic markets.

DuPont's economic base would be diversified (by replacement of jobs lost when the DuPont Company closed) and its fiscal position and revenues improved by the project. Adverse impacts of increased traffic congestion and loads on public utilities and energy consumption would be minor.

8.0 Irreversible or Irretrievable Commitments of Resources which should be Involved in the Proposed Action shoud it be Implemented

Construction of the proposed export facility would require the following irreversible resource commitments.

Fossil fuel would be consumed by construction equipment (approximately 72,800 gallons per year during the 2 to 2-1/2 year construction period), and a variety of mineral resources would be consumed during construction (sand and gravel for fill, paving materials, building materials). About 45,300 gallons of water per day would be used during construction for dust abatement. Approximately 400 megawatt-hours per year of electrical power would be used during facility construction.

During operation of the facility, up to 300,000 gallons of water per day would be required during summer months. Operational electrical power consumption would be 6.2 to 8.3 million kilowatt-hours per day. Annual fuel consumption at peak operating capacity would be 500,000 to 600,000 gallons of diesel, 80,000 to 100,000 gallons of propane, and 4,000 to 5,000 gallons of gasoline.

Other irreversible changes would include elimination of the existing pier habitat and removal of 169 acres of terrestrial habitat that would be covered by buildings, roads and other pavement and seriously affect 42 acres that would be encompassed within developed areas. On-site gravel resources would be less accessible.

9.0 Coordination with Others

9.1 COORDINATION

Key federal and state agencies involved with the proposed project include the Department of the Interior (U.S. Fish and Wildlife Service), National Oceanic and Atmospheric Administration, the Environmental Protection Agency, the Washington State Departments of Ecology, Fisheries, Game, Natural Resources, and Transportation. The local agencies with jurisdiction include the City of DuPont and Pierce County.

9.2 MEETINGS

Since January, 1976 when the proposed project was first announced, there have been several group meetings to discuss the project. A listing of the group and the number of meetings follows:

Group	Number of Meetings
City of DuPont, Nisqually Delta Association, League of Women Voters, Washington Environmental Council, Black Hills Audubon, Tahoma Audubon, Weyerhaeuser Evening Meetings	10
South Puget Sound area civic groups	28
Labor organizations	11
Representatives of governmental agencies	39
Public hearings/meetings	11
Education groups	18
Sportsmen groups	20
Special interest groups	31
Media contacts	28

9.3 COMMENTS REQUESTED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The draft Federal EIS was filed by Seattle District Corps of Engineers with EPA on 28 July 1979. A news release, issued by Seattle District on 29 July 1979, announced the availability of the draft Federal EIS to the public for review and comment.

The following agencies, groups, and individuals received review copies of this statement at the time the announcement of availability was made in the Federal Register 3 August, 1979.

Federal Agencies

Ralph M. Phillips, Regional Administrator, Federal Highway Administration
Donald P. Dubois, Administrator U.S. Environmental Protection Agency, Region X
Gilbert Haselberger, Chief, Conservation and Environmental Branch, U.S. Department of Energy
Dr. Sidney Galler, Deputy Assistant Secretary for Environmental Affairs, Department of Commerce
Dale Evans, Director, Environmental and Technical Services Division, National Marine Fisheries Service
George L. Capp, Field Supervisor, Division of Ecological Services, U.S. Fish and Wildlife Service
Ry Tanino, Environmental Officer, Department of Housing and Urban Development
Commander (dpl), Thirteenth Coast Guard District, ATTN: Planning Officer
Bruce Blanchard, Director, Office of Environmental Review, Department of the Interior
Charles Custard, Director, Office of Environmental Affairs, Department of Health, Education and Welfare
David Miller, Regional Environmental Officer, Department of Health, Education and Welfare
Ernest Sligh, Director, Environmental Impact Division, Federal Energy Administration
Theodore A. Schlapfer, Regional Forester, Forest Service, Region 6
Paul A. VanderMyde, Coordinator of Environmental Quality Activities, Office of the Secretary, U.S. Department of Agriculture
Rear Admiral F. Warren Kelley, Commandant, 13th Naval District, Naval Support Activity
Office of the Chairman, Pacific Northwest River Basins Commission
Jordan Tannenbaum, Advisory Council on Historic Preservation

State and Local Agencies and Groups

Orin Smith, Director, Office of Financial Management, Office of the Governor
Dean Cole, Director, Community Planning and Affairs Agency, Office of the Governor
Wilbur G. Hallauer, Director, Department of Ecology
Dennis Lunblad, Comprehensive Management Division, Department of Ecology, ATTN: Ms. Barbara Jansen
Richard D. Smith, Executive Director, Port of Tacoma
Gary Kucinski, Port of Tacoma
Patrick J. Gallagher, Chairman, Pierce County Commission
Mart Kask, Executive Director, Puget Sound Governmental Conference
Honorable Mike Parker, Mayor of Tacoma
Arpad L. Masley, Chairman, Washington State Ecological Commission
Puget Sound Air Pollution Control Agency, ATTN: Mr. A. R. Dammkoehler
Honorable John G. Iafrati, Mayor, City of DuPont
Dwight Hamdi, Tacoma Planning Department

Honorable A. L. Rasmussen, Washington Senate
Robert G. Anderson, Director, Department of Public Works
R. B. Davidson, Environmental Planner, Highway Administration Building
C. S. Gloyd, Washington State Department of Transportation
A. R. Morrel, District Administration, Washington Department of Transportation
Ms. M. Chalfant, Seattle Public Library
Tacoma Public Library
Pierce County Public Library
Olympia Public Library
David Maach, University of Washington Library, Reference Division
Documents Librarian, University of Oregon
Steilacoom Library
Puyallup Tribal Office
Documents Librarian, Colorado State University, Morgan Library
Francis J. Schadegg, Director, Center for Urban and Regional Planning, Eastern Washington State College
Clayton C. Denman, Ph.D., President and Co-Director, Small Towns Institute
Documents Librarian, Colorado State University, Morgan Library
Linda Hall, Library, Documents Division
Desiree Bradley, Librarian, Hatfield Consulting Limited, Environmental Management
Nisqually Indian Tribe

Environmental Groups

Nancy N. Kroenig, Tacoma Audubon
Douglas W. Scott, Northwest Conservation Representative, Sierra Club
Fayette Krause, President, Audubon Society
Dale Jones, Northwest Coordinator, Friends of the Earth
Leonard Steiner, Seattle Audubon Society
James Morris, President, Conservation of Natural Resources Association
Helen Engle, President, Washington Environmental Council
Huxley Environmental Reference Bureau, Huxley College, Western Washington State University
Dorothy Morrell, Washington Environmental Council
Dr. Donald E. Bevan, Greater Seattle Chapter, Izaak Walton League

Individuals and Groups

Liz Greenhagen
Elvin Ottey
Stephen Anderson
George L. Smith
James A. Van der Veey
Jim L. Tunison
David J. Hebert
Charles T. Keenan, Executive Director, Western Environmental Trade Association of Washington
H. Paul Friesma, Associate Professor, Northwestern University
O. Lincoln Cone, Coordinator for Operations, American Institute of Merchant Shipping

Donald J. Bale, President, Columbia-Pacific Resources Conservation and Development
Gail Halliday
Pete MacKenzie
Captain Addison E. McKimmey
Louis R. Despres
Eugenia Fairbanks
Jack Zidell
John A. Tanovich
Dr. Jack H. Hyde
Daphne Smith
Tyra Lindquist
Sally Klotz
Sharon Ashurst
Olive B. Guild
Anita Valigura
Marjorie Goodman
Robert A. Warfield, Major, USA (Ret.)
Claire E. Stevens
Dennis Braddock
Paul Jackson, KCPS Channel 13
Edward Cremmins, Herner and Company
S. D. Wheatley, Director, Study Center, National Maritime Research Center
John Isakson, Dames and Moore
Nancy Pearson, President, League of Women Voters of Tacoma-Pierce County
Katherine N. Cormier
Sarah J. Madsen

9.4 COMMENTS RECEIVED AT THE PUBLIC WORKSHOPS

A public workshop was held on 12 September 1979 at the Bicentennial Pavilion, Tacoma. Written transcripts of the workshops are available from the Seattle District office of the Army Corps of Engineers and also are contained in Volume III, Appendix R to this FEIS.

Written letters were also received in response to the Public Workshops. Copies of these letters are available at the Seattle District Office of the Army Corps of Engineers and are contained in Volume III, Appendix S to this FEIS.

The following individuals expressed opinions on the draft EIS. An (*) denotes a written response, in addition to, or in lieu of a verbal response:

Federal Agencies

U.S. Fish and Wildlife Service, Gary L. Kline
National Marine Fisheries Service, Clifford E. Soderstrom

State and Local Agencies

*Richard M. Bond, Washington State Representative
Washington Department of Natural Resources, Steve Robinson
Port of Tacoma, Hugh Wild
Lakewood Area Chamber of Commerce, Archie Heany
Anderson Island Park and Recreation District, Richard G. Anderson
*Washington State Department of Commerce and Economic Development, Paul Anton, Deputy Director

Indian Tribes

Squaxin Island Tribe, Jack Rensel

Organizations

Nisqually Delta Association, Jay W. Butts
Black Hills Audubon Society, Jack E. Davis
Save the Narrows, Tom Echert
Washington State Sportsmen's Council, Robert L. Elliott
Washington Environmental Council, Helen Engle
Tacoma Poggie Club, Earl Engman
Tahoma Audubon, Mike McCulley, Charles Plummer
Seattle Audubon Society, David Galvin
League of Women Voters, Nancy Pearson
Puget Sound Pilots Association, Dewey Soriano, Capt.
Tacoma Sportsmen's Club, Kenneth F. Johnson
Pierce County Labor Council, Clyde Hupp
*Washington State Sportsmen's Council, Robert L. Elliott, Water Access Chairman
*Tacoma Area Chamber of Commerce (Resolution)
*Washington Environmental Council, Helen Engle, President
*Tacoma-Pierce County Economic Development Board, Theron V. Rust, Executive Director

Individuals

Kenneth W. Braget, Braget Dairy Farm
Chas. R. Buchanan
Tom Ehrlichman
Carl B. Hupman
Todd Litman
Chuck Skillman, Washington Contract Loggers
Catherine Carroll, Nogler Tree Farm Collective
Lloyd Knutson
Nancy Kroening
Sarah Madsen
John McCloskey
Ann Mahuke
Anthony Melchiors, Weyerhaeuser Co.
Pam Miller
Dennis Rhodes
Ruth Weisberg
Susan Wertz
Mike Whitson, Nogler Tree Farm Collective
*C. David Gordon
*James A. Bryan
*Paul B. Williams
*Tom Ehrlichman
*Richard A. Turner
*Michael D. McCulley

*Ernest O. Salo, Professor Fisheries Research Institute, University of Washington
*Kathleen Thomas
*Ruth B. Weisberg
*Mr. and Mrs. Orville H. Rollefson

9.5 WRITTEN COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Seattle District received written comments from individuals on the Draft Environmental Impact Statement from 29 July 1979 to 3 March 1980. Copies of these letters are available at the Seattle District Office and are included in Volume III, Appendix T. Each letter is numbered and environmental concerns raised have been indicated by a letter of the alphabet representing a specific environmental topic. The index, which follows this page, indicates the source and date of each comment letter. Responses to environmental concerns are found in Section 9.7. The following key shows where in Section 9.7 the responses may be found.

INDEX

Arranged numerically by originating agency

	Author/Organization	Date
14.	U.S. Environmental Protection Agency (L. Edwin Coates or Donald P. Dubois, Regional Administrator)	3 Oct. 79
15.	U.S. Department of Agriculture, Forest Service, Region 6, Portland, OR (D. H. Morton for R. E. Worthington, Regional Forester)	9 Oct. 79
16.	U.S. Department of the Interior, Office of the Secretary, Pacific Northwest Region, Portland, OR (Charles S. Pollityka, Regional Environmental Officer)	12 Oct. 79
17.	Washington State Parks and Recreation Commission (David W. Heiser, Chief, Environmental Coordination)	27 Aug. 79 14 Sep. 79
18.	Washington State Department of Game (Fred H. Maybee, Assistant Program Manager, Environmental Affairs, Habitat Management Division)	14 Sep. 79
19.	Washington State Department of Game (Fred H. Maybee, Assistant Program Manager, Environmental Affairs, Habitat Management Division)	5 Oct. 79
20.	Washington State Department of Transportation (Wm. P. Albohn, Environmental Planner, for Robert S. Neilsen, Assistant Secretary)	19 Sep. 79
21.	Washington State Department of Ecology (Wilbur G. Hallauer, Director): coordinated responses including letters from the Departments of Game and Transportation	25 Sep. 79
22.	Department of Fisheries	25 Sep. 79
23.	Washington State Capitol Museum (Delbert J. McBride, Curator)	27 Sep. 79
24.	Washington State Office of Archaeology and Historic Preservation (Sheila A. Stump, Archaeologist for Jeanne M. Welch, Deputy State Historic Preservation Officer)	15 Oct. 79
25.	Washington State Department of Commerce and Economic Development (Paul Anton, Deputy Director)	10 Sep. 79
Local Agencies		
26.	City of DuPont (John G. Iafrati, Mayor)	20 Aug. 79
27.	City of DuPont (John G. Iafrati, Mayor)	16 Oct. 79

Author/Organization	Date
28. Puget Sound Air Pollution Control Agency (A.R. Dammokoehler, Air Pollution Control Officer)	21 Sep. 79 3 Oct. 79
29. Puget Sound Council of Governments (Francesca Shultz, Subregional Coordinator)	
30. City of Tacoma (Mike Parker, Mayor)	

Organizations

31. Washington Kayak Club	24 Sep. 79
32. Nisqually Delta Association (Flo Brodie, President)	26 Sep. 79
33. Nisqually Delta Association (Flo Brodie, President)	12 Oct. 79
34. Tahoma Audubon Society (Nancy Kroening)	26 Sep. 79
35. Tahoma Audubon (Michael D. McCulley, Conservation Chair)	28 Sep. 79
36. Tahoma Audubon Society (Nancy Kroening)	11 Oct. (recd. ND)
37. Seattle Audubon Society (David V. Galvin, Conservation Chair)	27 Sep. 79
38. Puget Sound League of Women Voters (Nancy Pearson, Nisqually Chairperson, for Hilda Skolnick, Puget Sound President, and Jane Shafer, President, League of Women Voters of Washington)	27 Sep. 79
39. Washington Environmental Council (Helen Engle, President	28 Sep. 79
40. Black Hills Audubon Society (William Harrington-Tweit, President)	28 Sep. 79
41. Boston Harbor Association (Mary Murphy, President)	29 Sep. 79
42. Sportsmen's Council, Inc.	11 Sep. 79
43. Tacoma Area Chamber of Commerce	10 Sep. 79
44. Tacoma Pierce County Economic Development Board	9/79 (ND)
45. Western States Regional Council No. III, International Woodworkers of America, AFL-CIO (Vernon C. Russell, President)	6 Sep. 79
46. Pierce County Central Labor Council, AFL-CIO (H. Russell Peters, Secretary, Pierce County, Washington Building and Trades Council, and Clyde H. Hupp, Secretary, Pierce County Central Labor Council)	19 Sep. 79

Author/Organization	Date
Individuals	
47. Donald C. Orlich	10 Sep. 79
48. Kathleen Thomas	14 Sep. 79
49. Pete MackNezie	17 Sep. 79
50. Robert T. Smith	18 Sep. 79
51. (Dr. and Mrs.) Henry H. and Jean Kyle	20 Sep. 79
52. William and JoAnn Lysak	21 Sep. 79
53. Mary Sturm	24 Sep. 79
54. Charles Plummer	24 Sep. 79
55. Dolories Osland	25 Sep. 79
56. Pam Miller, Cascadia Research	25 Sep. 79
57. Janet Buresh	26 Sep. 79
58. Conrad Driscoll	26 Sep. 79
59. Julie Johnson	26 Sep. 79
60. Irene Christy	26 Sep. 79
61. Sarah J. Madsen	27-28 Sep. 79
62. Stan Isley	26 Sep. 79
63. Derek Valley	27 Sep. 79
64. Dorris Hensel	27 Sep. 79
65. Jack E. Davis	27 Sep. 79
66. Richard G. Anderson	27 Sep. 79
67. Walter O. Marcelline C., and Kenneth W. Braget	27 Sep. 79
68. Elizabeth Tabbutt	28 Sep. 79
69. Jay W. Butts	28 Sep. 79
70. Robert W. Ramsey, L.A.	28 Sep. 79
71. Gene Baxstrom	28 Sep. 79

	Author/Organization	Date
72.	Terry Corrigan	28 Sep. 79
73.	Morry Browne	28 Sep. 79
74.	Howard W. Millan	28 Sep. 79
75.	(Mr. and Mrs.) William R. and Marie B. Stillwell	28 Sep. 79
76.	Timothy A. Pearce	28 Sep. 79
77.	Sally Klotz	28 Sep. 79
78.	Ruth Carson	28 Sep. 79
79.	Barbara Damon	28 Sep. 79
80.	Richard G. Anderson (includes petition signed by 208 property owners of Anderson Island, Washington)	not dated
81.	E. Eric Knudsen	2 Oct. 79
82.	Peter Swensson	4 Oct. 79
83.	Dave Howard	4 Oct. 79
84.	Liz Greenhagen	5 Oct. 79
85.	Liz Greenhagen	11 Oct. 79
86.	Laura Deschner	9 Oct. 79
87.	Gwen and Toni Soburalski	14 Oct. 79
88.	Susan Wertz	14 Oct. 79
89.	Ruth B. Weisbeg	18 Sep. 79
90.	Ernest O. Salo	12 Sep. 79
91.	Richard A. Turner	12 Sep. 79
92.	Tom Ehrlichman	12 Sep. 79
93.	Paul B. Williams	9 Sep. 79
94.	James A. Bryan	7 Sep. 79
95.	Michael D. McCulley	Sep. 79 (ND)
96.	Theodore Paul Hunter, Atty.	5 Oct. 79
97.	C. David Gordon	5 Sep. 79
98.	Mr. and Mrs. Orville H. Rollifson	20 Sep. 79

9.6 COMMENTS RECEIVED ON THE PUBLIC NOTICES

Letters were received by Seattle District, Army Corps of Engineers, in response to Public Notice 071-OYB-1-005087, dated 31 August 1978, 1 July 1979, 4 September 1979 and 23 January 1981 for the Section 10 permit application. Copies of the Public Notices are in Volume II, Appendix A. The first three Public Notices refer to the northernmost dock as the proposed location. The 23 January 1981 Public Notice identifies the southern dock location as the proposed location. Comments from Federal agencies, state agencies, local agencies, and organizations are summarized, while names of individuals who submitted written comments are listed in tabular form. A (1) indicates the letter was in response to the first Public Notice, a (2) indicates the letter was in response to the second Public Notice, a (3) indicates the letter was response to the third public notice, and (4) indicates the letter was in response to the fourth public notice. Copies of these letters are available at the Seattle District Office, Army Corps of Engineers.

Federal Government Agencies

Department of the Interior, U.S. Fish and Wildlife Service (FWS)
- (1,2,4) Requested that permit be held in abeyance until FWS had opportunity to review the draft and final NEPA EIS

Environmental Protection Agency
- (1,4) (Same as FWS.)

National Oceanic and Atmospheric Administration - National Marine Fisheries
- (1,4) Service (Same as FWS)

U.S. Coast Guard
- (1) Comments withheld pending completion of the Federal EIS
- (3) Stated they have no objection to issuance of the Section 10 permit

State Government Agencies and Officals

Department of Fisheries
- (1) Approval withheld pending project compliance with the State Environmental Policy Act.

Washington Department of Game
- (1) Requested that the permit be held in abeyance until the requirements of the State Environmental Policy Act and the National Enviornmental Policy Act have been satisfied.

Shirley Winsley, State House of Representatives
- (3) Recommend issuance of the permit

Phillis K. Erickson, State Representative
- (4) Expressed concern about the long legal delays, stating Weyerhaeuser Co. needs to know whether it can proceed with the project. Urged concern and caution when the Corps considers permit approval.

Department of Transportation
- (2) Stated they have no objections to revisions indicated in public notice.

Local Jurisdictions

City of DuPont, Mark S. Jackson, Special Projects Officer
(4) Enclosed a copy of the Shoreline Substantial Development Permit issued to Weyerhaeuser Company on 19 February 1981.

Organizations

Squaxin Island Tribe
(2,4) Emphasized that the proposed Weyerhaeuser Export Facility at DuPont is within the fishing grounds (subarea 13 B-1) that is shared with the Medicine Creek Tribe. Objects to the DuPont location and suggest the facility be located in Commencement Bay.
(2) Request an extension of the 31 July 1979 deadline for comments on the DEIS.

Western Environmental Trade Association
(4) Approves of the proposed Weyerhaeuser Dock at DuPont because it will enhance the State's economy, nation's balance of payment, and generate jobs in the area

Nisqually Indian Tribe
(1) Expressed concern that the project would negatively impact its fisheries resources, cultural resources, and the safety of its commercial fishermen.
(3) DEIS does not adequately discuss impacts on treaty fishing rights.
(4) Opposed to alternative dock location and request a supplemental draft EIS on the alternative dock site

League of Women Voters of Tacoma-Pierce County
(1) Expressed concern that the proposed activity would have major impacts on critical and fragile habitat in the Nisqually Reach and Delta. Requested that a public hearing be held.

League of Women Voters of the United States
(3) Request that there be careful consideration of any plan, such as the prooposed Weyerhaeuser Export Facility at DuPont that deviates from the State Shoreline Management Act.

Nisqually Delta Association
(1) Expressed concern in the following areas: (1) Construction and use of the proposed project will have a significant detrimental effect on the biological and cultural resources. (2) The project is in violation of Washington State's Shoreline Management program. Current Washington State Department of Natural Resources policies would not permit new port construction if existing ports can handle the proposed traffic.
(2) Need an EIS for the alternative dock location (the now proposed southern location)

National Audubon Society
(2) Expressed concern that this project may set a precident for future development of shoreline designated by Washington State's Shoreline Management Act as having "statewide significance". If the proposed development at the DuPont Site is approved it may "render the Act ineffective".

Tahoma Audubon Society

(1) Expressed concern in the following areas: (1) gradual development of a new, major port facility; (2) proximity to Nisqually Wildlife Refuge; (3) ability of southern Puget Sound to "cleanse" itself; (4) and destruction of significant historical and archaeological sites. The Society passed a resolution that the permit not be granted and public acquisition of the site be pursued.

(2) The Society reiterated their concerns about the impact of future developments on the site.

Black Hills Audubon Society

(4) Request a supplemental draft EIS for the proposed southern dock site.

Seattle Audubon Society

(1) Objected to the issuance of a permit because of a proposed land use which would be incompatible with the surroundings. Requested studies to determine the effect of the proposed development on the adjoining conservancy area.

(2) Expressed opposition to an industrial operation located near an area as unique and sensitive as the Nisqually River Delta. The project would be contrary to the "spirit of the Washington Shoreline Management Act".

Tacoma Sportsmen's Club, Inc.

(3) Endorse permit issuance based on the "long and complete study of the project and its impacts."

Washington Federation of State Employees, AFL-CIO

(3) Opposed to the development of a log export center at DuPont because the harmful effects on wildlife and because the exportation of logs to foreign countries would eliminate jobs in the United States.

Defenders of Wildlife

(2) Opposed to the proposed export facility at DuPont because the most appropriate use of this land is for wildlife and for future generations.

Sierra Club, Cascade Chapter

(4) Opposed to project and specifically the new southern dock location, because it is not in the public's best interest.

Northeast Thruston Action Association

(4) Opposes issuing a permit to the Weyerhaeuser Company.

<u>Individuals</u>

(1,4) Sarah J. Madsen
(1) Daphne Fisher Smith
(1,4) Tyra Lindquist
(1,4) Law Offices of Henry E. Lippek
(1) Washington Environmental Council (Liz Greenhagen, Estuaries Committee)
(1) Christopher Evans
(1) Abie Moe
(1) Olive B. Guild
(1) Anita Valigura
(1) Marjorie Goodman
(1) Robert A. Warfield, Major, USA (Ret)
(1) Sharon L. Ashurst
(1) Katherine N. Cormier
(1) Dennis M. Kaech

(2) (Dr. and Mrs.) Henry H. and Jean Kyle
(2) Mary Sturm
(2) Nancy N. Kroening
(2,3) Theodore Paul Hunter, Attorney at Law
(2) Sarah Madsen and Tom Ehrlichman
(2) Gwen and Toni Soburlaski
(1,2) Sally Klotz
(3) Lael Zylstra
(3) Diana I. McKiurigan
(3) Washington Contract Loggers Association (Charles P. Skillman, Executive Secretary)
(3) The Prescott Company (George T. Prescott)
(3) Alan G. Ogren
(3) Reliable Steel Fabricators, Inc. (Gil Olson, Chief Executive Officer)
(3) E. Aldrich
(3) Mary Ann Whitley
(3) Zittel's Marina, Inc. (Michael D. Zittel, President)
(3,4) Allen Beaulieu
(3) D. W. Gross
(3) Thelma T. Gilmur
(3) Shelley A. Evans and Mary E. Burg
(3) Gail Billings
(3) Laurie Hillyard
(3) Christine Anderson
(3) John and Myrna Rieck
(3) James A Stuart
(3) Myrtle Poston
(3) Hazel Heckman
(3) Evelyn L. (Mrs. James M.) Morrison
(3) Nancy W. Pietela
(3) J. M. Peterson
(3) Janice Hillyard
(3) Anna M. Miskovsky
(3) William H. Edmondson
(3) Doris S. Cellarius
(3) Thomas G. and Cynthia Harmon
(3) P. Douglas House
(3) Jmes F. Galbraith
(3) Mrs. L. A. Coder
(3) Hazel A. Wolf
(3) Dawn C. Garcia
(3,4) Benjamin Weisberg, Col., USA (Ret)
(4) Ruth Weisberg
(3) Mrs. Harold Hansen for Capt. Harold Hansen (Ret)
(3,4) Michael D. McCulley
(3,4) Curtis Ivey (Major, USA, Ret) and Inge A. Ivey
(3) Rochelle S. Giddings
(3) Conservation Northwest (J. W. Slipp)
(3) Bob Sojak
(3) Vern Morgus
(3) Walter O., Marcelline C., and Kenneth W. Braget
(3) Kenneth L. Mostow
(3) Renee Buss
(3) Sara Jordan
(3) Lynn Phillips

(3) Jose (Mrs. C. L.) Taylor
(3) Ned Weaver
(3) Judith R. Dearden
(3) L. R. and Margorie T. Montgomery
(3) Sue H. Walbridge
(3) James D. Grindell (Col., USA, Ret) and Emily J. Grindell
(3) Jan Verduin
(3) Jocelyn Dohm
(3) Gerry Lemon Moeller
(3) Marian Troy Lemon
(3) G. E. Madden
(3) Janice Madden
(3) Ronald A. Wertz
(3,4) Susan Wertz
(3) Leonard Steiner
(3) Jan Shara
(3) Shari Dixon
(3) Judy Stape
(4) Gretchen Londahl
(4) Mr. and Mrs. Harold Kooley
(4) Pam Miller
(4) Edria R. Kohler
(4) Ruby E. Egberd
(4) Dan Vanderkolk
(4) Kathleen M. Banner
(4) Dennis Gross
(4) Jeff and Anne Yerger
(4) Mona J. Fisher
(4) Jim and Conni Van Hoose
(4) Janet Buresh
(4) Jeanette L. Boege
(4) Tina Munhollon
(4) Susan A. Martin
(4) Mark Hays
(4) Eric J. Bailey
(4) Susan Girard
(4) William T. Britton
(4) Pattie J. Ines
(4) Carol Kimbel
(4) Richard Trudeau
(4) Kenneth MacLagan
(4) Priscilla Kepler
(4) L. R. and M. Montgomery, et. al. (signatures of others supporting this
(4) letter are on file at the Corps of Engineers)
(4) Kenneth G. Spinharvey
(4) Bernard T. Harvey
(4) Michael J. Kadmorey
(4) Daniel and Grace Morris
(4) Mrs. Bernard Witte
(4) Shirley J. Beelik
(4) Carolyn Maddux
(4) John Biggs

(4) Flo Brodie
(4) Harold D. Mitchell
(4) Lacy Van B. Mitchell
(4) Ann Cross Eschenbach

9.7 A SUMMARY OF COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND RESPONSES

COMMENTS AND RESPONSES

TABLE OF CONTENTS

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

Section 9.7 is organized into general comment categories that were developed from 98 comment letters (Appendix T) received by the Corps of Engineers on the DEIS. The alphabet letters prior to the comment category titles (i.e. A. NEED FOR THE PROJECT) can be cross referenced with the numbers identifying specific comment letters in Section 9.5.

A. NEED FOR THE PROJECT

Comment Letters: 1,31,32,34,37,56,59,62,70,81,85,88,89

Comment 1

The potential economic and environmental impacts of continued and increased log exports should be more fully discussed, especially in view of a possible ban on log exports. This discussion should include the impact on our forest resources, including whether our forests sustain the present and proposed level of export activity.

Response 1

See revised Section 1.1.1.1, Appendix B, and in Appendix T, letter 25. Basically, developing an export facility at DuPont would not increase the number of logs exported. It would shift the location from where the export takes place. The project concept is to maintain and increase a competitive position in world markets for northwest forest projects, focused upon finished products (Appendix B).

Comment 2

In light of the estimate by Data Resources, Inc., of Lexington, Mass., that log exports to Japan from Washington State would cease by 1985, relevant trade figures to support development of this port should be developed.

Response 2

First, log and wood products exports to Japan from Washington State are not expected to cease by 1985 nor in the foreseeable future. Secondly, as stated in Section 1.1.1.1, Weyerhaeuser would export more and more finished products, thus reducing the proportion of log exports over time. The facility is designed and planned for such finished products, not specifically for logs (see Appendix B).

Comment 3

Would the proposed facility mean a total increase in log exports or merely a shift of present export activity from other sites?

Response 3

As stated in Volume I of the Final Environmental Impact Statement (FEIS), log exports would not increase, they would be shifted to DuPont from Weyerhaeuser's Tacoma operations and to a smaller extent from Everett and Longview. Also refer to response 7, below.

Comment 4

What domestic markets are available for logs through the year 2000? Could domestic markets serve to eliminate Weyerhaeuser's need for log exports while preserving jobs for U.S. workers?

Response 4

According to Weyerhaeuser, the proposed action, building an export facility at DuPont, is to reduce export costs and make Weyerhaeuser more competitive in foreign markets for a wide variety of forest products, particularly finished products. As indicated in Appendix B, domestic market opportunities and continue to decline for the Northwest forest products industry. The state "log export" issue is separate from the proposed action. See letter 25 in Appendix T. Also, see response 2 above.

Comment 5

What is the future market for export of finished timber products?

Response 5

According to Weyerhaeuser, the future market for exporting finished products is improving. How much it would improve, as far as the Northwest's competitive position in world markets, would depend on the ability of Northwest producers to guarantee cost-competitive delivery (Appendix B).

Comment 6

What effect would the proposed widening of Grays Harbor have on Weyerhaeuser's operations?

Response 6

According to Weyerhaeuser, it would improve Weyerhaeuser's operations at Grays Harbor, but not minimize or eliminate the Company's need for the DuPont facility.

Comment 7

How many tons of forest products are now exported by Weyerhaeuser from each of the Northwest ports it now uses and how would this tonnage be affected by the facility?

Response 7

At design capacity, which would be reached near the turn of the century, the DuPont facility would handle two million tons per year of forest products exported by Weyerhaeuser. Weyerhaeuser projects that by the year 2000, exports from their Washington shipping facilities are expected to exceed current levels by more than two million tons. That future volume corresponds to approximately 25 percent of today's total export tonnage from Weyerhaeuser operations--the bulk of which came from the State of Washington. (Because customs districts and shipping statistics overlap state boundaries, particularly in the Portland-Vancouver-Longview area, it is difficult to determine export volumes on a state-by-state basis. Generally speaking, over three quarters of Weyerhaeuser's current exports originate from Washington State.) It should be noted that Weyerhaeuser's total export tonnages are expected to increase during the intervening two decades. Thus significant tonnages would continue to be shipped through existing Weyerhaeuser locations.

Compared to current annual total production from Weyerhaeuser operations in Washington State alone, the two million tons through DuPont also would be the equivalent of some 20 to 25 percent. Like exports, total Weyerhaeuser production in the state is also expected to increase over time.

In the short-term (two to five years after start-up), export tonnage from DuPont would represent a shift from other Weyerhaeuser shipping operations. The majority of the start-up tonnage would be the full or partial transfer of the Tacoma (log) Sort Yard's volume. Other shipping point shifts in the short-term would be from Longview and, to a much lesser extent, from Everett. Longview is and will remain for the foreseeable future Weyerhaeuser's largest shipping facility in terms of shipped tonnage. In 1980, Longview shipments amounted to more than four million tons. No significant shifts in exports fromm Weyerhaeuser's Grays Harbor facilities are expected. Current shipping volumes from Weyerhaeuser shipping facilities are not needed to represent the effect of the proposed DuPont facility on Weyerhaeuser operations.

Comment 8

How much of Weyerhaeuser's future timber needs would come from national forests?

Response 8

The primary source of wood and wood fiber for exports shipped through DuPont would be commercial forest lands owned and managed by Weyerhaeuser in Snohomish, King, Pierce, Thurston, Lewis, Grays Harbor, Pacific, Wahkiakum

and Cowlitz Counties. The DuPont site is located near the approximate geographic center of these timberland ownerships and the manufacturing facilities they serve (Volume I, Chapter 6 of the FEIS).

Weyerhaeuser does not buy U.S. Forest Service (USFS) timber in Western Washington, and has no plans to do so. In fact, it is prohibited from doing so as long as the company's annual log exports from Western Washington exceed 110 percent of its 1971-1973 average annual log export volumes from that area (36 CFR 223.10). However, Weyerhaeuser does trade logs with a variety of sources, including small volumes from USFS lands, to save transportation costs and adjust its log inventories to better match its manufacturing operations.

Comment 9

What proportion of Weyerhaeuser's income is now derived from log exports?

Response 9

Weyerhaeuser does not publish information on earnings from log exports except when aggregated with other product lines. The proportion of income derived from log exports is not relevant to this EIS.

Comment 10

Is Weyerhaeuser greatly expanding its log exports in competition with other established giants, such as Simpson?

Response 10

No, log exports have been relatively stable for the past six to eight years and are expected to remain relatively stable or decline somewhat. Both large and small companies compete in the log export business.

Comment 11

Please state three or four options other than international rapid export of logs that Weyerhaeuser could pursue for future economic stability.

Response 11

As stated in response 2, the proposed export facility over time would have an increasing volume of finished products over log exports. Weyerhaeuser has underway a major expansion of its joint venture newsprint manufacturing facility at Longview, and plans have been announced for construction of a new sawmill in Western Washington (Raymond). Appendix B describes the Weyerhaeuser planning process and competitive position in the Northwest forest products industry.

Comment 12

The public benefit of this facility in light of both its potential environmental impacts and policies to avoid proliferation of private ports should be clarified. A cost-benefit analysis should be done to determine whether this facility would be in the long-term interest of the state.

Response 12

See revised Sections 4.17, 1.1.1.1, Letter 25 in Volume II, Appendix T and Appendix B of the FEIS. Each permitting, licensing, and approving agency will have to weigh the positive and negative aspects of the proposed project. Most of these agencies have the authority to condition an approval should they so decide with measures to minimize impacts or compensate for losses. The negative environmental and economic costs are discussed in Chapter 4. Some public benefits associated with the proposed project are listed below:

a. Increasing exports would strengthen the U.S. economy and the dollar in world markets; generating a favorable balance of trade; and contributing to world stability through the development of common trade dependencies.

b. Increased forest product sales benefit loggers, truckers, foresters, manufacturing workers and the suppliers who depend on them.

c. Over time, increasing amounts of finished forest products would be shipped from DuPont. Additional finished forest products would produce more employment opportunities throughout Western Washington.

d. Reducing shipping costs of finished forest products would make Weyerhaeuser more competitive in the world market to sell more thus benefiting the state and national balance of trade and allowing it to maintain higher production levels in times of weak market demand.

e. Increased sales to foreign markets would help stabilize the cyclical lumber and plywood industries thus stabilizing employment.

f. Increased market opportunities for forest products would make silvicultural investment profitable and thus reduce the pressures for conversion of the land to urban/suburban uses.

Comment 13

What controls are needed to ensure that increased log export activity would not present unreasonable burdens for the state?

Response 13

Construction of the facility would not increase log exports. See response 2. Appendix B contains additional background information.

Comment 14

Do we need a major, new, rapid-export port for Washington wood products at the proposed location when over two million dollars of public funds have already been committed for acquisition of delta lands, or Congress may limit log exports?

Response 14

This EIS was written to assess the potential and likely environmental impact on the site and surrounding areas, including the delta. The justification for the project appears in this FEIS in Section 1.1.1.1 and Appendix B. The log export issue is discussed in response 2.

Comment 15

What is the public benefit of developing the proposed port on environmentally sensitive lands especially when Weyerhaeuser's competitors would be required to use public ports?

Response 15

Competitively with other forest product companies, there would be no change since Weyerhaeuser Company presently ships from its own dock facilities at other locations (Everett, Tacoma, Longview, Cosmopolis, and Aberdeen). Only Weyerhaeuser cargo is shipped over these docks. Some of Weyerhaeuser's competitors have similar private docks, while others utilize public docks. When cargo of other shippers is accepted aboard the company's chartered vessels, it is loaded at public docks or the owner's private docks; the proposed project would not affect this. No revenue accrues to public ports from shipments over private docks, wherever they are located. Therefore, the DuPont export facility and its private dock would not take business (or revenue) away from any public ports. See response 12 for some of the benefits to compare with the environmental costs discussed in Chapter 4.

B. FUTURE DEVELOPMENT

Comment Letters: 1,6,7,14,16,18,32,34,37,39,40,51,56,58,59,61,62,64,66,67,69, 76,77,78,81,85,86,87,88,89,92.

Comment 1

Secondary or induced impacts from future development of the DuPont site should be considered according to NEPA and the new guidelines from the Council on Environmental Quality (CEQ), effective July 30, 1979. Because the proposed project involves development of only 250 acres held by Weyerhaeuser Company, further industrial development of the site and impacts on the environment beyond the scope covered in this EIS should be considered. The cumulative effects of development should be thoroughly assessed, including induced urbanization, and the natural, social, and service systems of Thurston and Pierce counties. The increased probability of induced future industrial development of adjoining and nearby areas, together with resulting environmental impacts, should be discussed. The potential for future development is increased by the fact that the City of DuPont has zoned the entire site as industrial.

Response 1

These topics have been discussed in detail in the FEIS. Refer to Section 1.6, as modified, and Appendix B of this FEIS.

Comment 2

Weyerhaeuser should disclose a detailed comprehensive plan for future development of the site, including term of facility usage, type and schedule of expansion, whether other companies would use the facility, and what kinds of products these other companies would export. Even though final plans for future development may not exist, each possible type of development should be disclosed and the impacts analyzed.

Specific concerns include:

a. Is it the company's understanding that the EIS and baseline data are sufficient to support future development of the site?

b. The EIS should consider a binding agreement between the Corps and Weyerhaeuser (or appropriate permit conditions) to prevent further industrial development on the site until the City of DuPont completes a comprehensive plan update providing buffer zones to protect the delta and refuge.

c. The environmental impacts of existing comparable public ports should be assessed and used as an indication of possible impacts from the proposed facility.

d. The EIS should state that future development would most likely require fewer and easier-to-acquire permits.

e. Prospective discharges and levels of treatment for future operations should be part of the assessment of secondary impacts.

f. Impact assessment from future development should include effects of light and glare on migrating birds.

g. Who would pay for the increased services required by future development?

h. The study fails to address the incentive for future residential development of Weyerhaeuser's 1,000 acres at Hawks Prairie.

Response 2

See Volume I, Section 1.6 and Appendix B of the FEIS. Any additional projects on the site, if proposed, would have to be reviewed under the appropriate federal and state environmental policy act laws and guidelines by the responsible officials who would determine if any proposed project would require an EIS. Weyerhaeuser Company had the consulting firm of Pereira and Associates determine the best location of industrial development on the site. They identified a consolidated site using about 189 of the 3,200 acres for industrial development. It is there where the export facility would be located. Whether the existing baseline information would be sufficient to analyze a new proposal would have to be determined relative to what is proposed and where it is proposed. At that time, all potential impacts related to such a proposal would have to be analyzed, including cumulative impacts of the new proposal and the export facility, if built. A separate permitting process would be required; the nature and types of permits would be dependent upon the nature of the proposal. The Corps of Engineers would be involved with permits only if a Section 10 or Section 404 permit application were involved.

The City of DuPont is in the preliminary stages of a comprehensive plan update. In this regard, Weyerhaeuser has agreed not to construct any major facilities within the city, other than the proposed export facility, until completion of that plan or January 1984, whichever is earlier. A copy of the course of work may be obtained from the city.

The Memorandum of Understanding (MOU) between the USFWS and Weyerhaeuser when finalized would establish mutually agreeable buffer zones to reduce project impacts on the delta and refuge, if the project is built. Weyerhaeuser is bound to the provisions of this MOU by an agreement between Weyerhaeuser, the Washington Department of Ecology, and the City of DuPont. Refer to Volume I, Section 3.2 for more discussion of this agreement and Section 3.3 for details of the MOU.

Weyerhaeuser Real Estate Company, a subsidiary of Weyerhaeuser, has proposed future residential and commercial development at Hawks Prairie. This proposal is independent of the proposed export facility and is expected to proceed regardless of whether the export facility is constructed. As indicated in this EIS, the export facility related employment can be served by existing housing and governmental services.

C. ALTERNATIVES

Comment Letters: 1,6,7,14,16,19,32,34,36,37,38,39,53,56,59,61,64,69,71,72, 75,76,77,78,80,81,84,85,88,89,92

Comment 1

The discussion of alternatives to the DuPont site is not adequate. In particular, the rationale for the specific site selection criteria needs to be explained. The process of site selection also needs discussion, especially the screening of the 28 sites down to four. The basis of selecting DuPont from the four final alternatives should be discussed, especially in terms of the criteria for centralized location, additional acreage for development, and deep water. The discussion should include impacts on the socioeconomic and natural systems of all the alternatives including Indian treaty fishing rights. The no-action alternative also needs further discussion since environmental and public groups as well as individuals have shown much interest in preserving the site and adjacent areas.

Response 1

The alternatives chapter (Chapter 6, Volume I) has undergone major revisions for the FEIS. Weyerhaeuser's site selection process has been clarified (Section 6.3) and the Weyerhaeuser document, which was written to describe their site selection process, has been included in Appendix N of the FEIS. Additional discussion in Section 6.3 has been added to clarify Weyerhaeuser's criteria for site selection, including centrality of location and required depth. An environmental impact matrix (Table 33) for the four final alternatives has been included to provide a comparison of expected impacts of the alternatives. A discussion of impacts on Indian treaty fishing rights has been added to the environmental comparison of the various sites. Much of the design alternative material has been moved to Appendix N to improve the readability of the alternatives chapter.

If the no-action alternative results, i.e. the Corps of Engineers' Section 10/404 permit is denied, it is probable that development of the site would occur at some time in the future either by Weyerhaeuser Company or some future land owner. Since the effects on the human and natural environments would vary with the nature of the kind of development occurring on the site, it is not possible to predict impacts without specific knowledge of proposed projects. Some development alternatives are suggested, however, in Section 6.2. If the Corps of Engineers' permit were denied, impacts to the marine environment discussed in Volume I of the FEIS (Sections 4.8, 4.9, and 4.10) would be avoided.

Comment 2

The inadequacy of existing public and private ports needs further justification. The alternative of expanding or making more efficient use of existing port facilities, both public and Weyerhaeuser's especially Longview and Tacoma, should be addressed.

Response 2

See expanded discussions in Section 6.3 concerning the alternatives of using existing public ports and existing Weyerhaeuser facilities for the proposed export facility.

Comment 3

The inadequacies of the Port of Tacoma appear contradicted by the Corps of Engineers' 1975 report, recent brochures by the port, and a Sea Grant publication, "Port Expansion in the Puget Sound Region."

Response 3

The suitability of the Port of Tacoma as an alternative site for the proposed export facility is discussed in Sections 6.3 and 6.4. The inadequacy of the Port of Tacoma to provide 200 adjoining acres for unloading, staging, and loading ships is upheld by information obtained from officials of the Port of Tacoma. Use of the Port of Tacoma would require substantial modifications in Weyerhaeuser's proposal, as well as a change in policy by the Port of Tacoma, with a stated opposition to locating the proposed export facility at the Port of Tacoma (Appendix O).

Comment 4

The document mentioned in the DEIS in which Weyerhaeuser summarizes its consideration of 29 sites, 1973-75, should be referenced and made available.

Response 4

The summary document prepared by Weyerhaeuser Company to describe its site selection process, 1973-1975, has been summarized in Section 6.2 and included in Appendix N of the FEIS.

Comment 5

The centralized location requirement needs clarification. Why were sites on the Columbia River and northern Puget Sound originally considered if they were then eliminated on the grounds of not being central enough?

Response 5

According to Weyerhaeuser, assessment of centrality was subjective based on distance and transit time from Weyerhaeuser production facilities and the supporting timberlands. Figure 56 shows the existing sources of product supply. That locations in northern Puget Sound are not central to product supply is apparent. Most locations along the Columbia River were, in fact, rated marginal for centrality. These locations were eliminated from further consideration by Weyerhaeuser because of failure to satisfy more than one mandatory site characteristic. See Section 6.2 for more detailed consideration of Weyerhaeuser's selection process.

Comment 6

The alternative of working with state port authorities to find a suitable existing port should be mentioned.

Response 6

An expanded discussion of the suitability of existing port districts for the proposed export facility is contained in Section 6.4.

Comment 7

More information is also needed on the feasibility of ports at Everett, Aberdeen, Olympia, Cosmopolis, Raymond, Cherry Point, Grays Harbor and Port Angeles as alternative sites. Of the 28 original sites, 12 met the mandatory criteria. They should be given independent review as alternatives: March Point, Willow Grove, Barlow Point, Woodland, Austin Point, Kromminga, Hewlitt Point, Matthews Point, St. Helens, Prescott, Rainier, and Point Westward.

Response 7

Refer to Sections 6.3.2 and 6.3.3 for discussion on the unsuitability of Everett, Aberdeen, Olympia, Cosmopolis, Raymond, Cherry Point, Grays Harbor, and Port Angeles as alternative sites for the proposed export facility.

Results of the screening process carried out by Weyerhaeuser for the other sites listed above are shown in Section 6.3, Table 27. Constraints in at least two of the five mandatory site characteristics resulted in their elimination from further consideration by Weyerhaeuser as viable alternatives.

Comment 8

The alternative of updating an existing port with the new technology necessary, and making it available for all timber companies to benefit the public and gain a worldwide competitive advantage should be addressed.

Response 8

The proposed project is for a single user and property owner (Weyerhaeuser) to develop an export site at DuPont. The FEIS examines other feasible alternatives to this type of development (Chapter 6). The suggested alternative for a facility to be used by all timber companies is not considered an alternative to the proposed project.

Comment 9

Economic comparisons of the use of existing facilities with development of the DuPont site should be made.

Response 9

According to Weyerhaeuser, because their existing Weyerhaeuser facilities cannot adequately accommodate the proposed export facility, or anticipated export flows of manufactured products, an economic comparison cannot be made. As well, other ports were considered (Chapter 6) and they were unable to accommodate the project concept. If the no-action alternative occurs, then Weyerhaeuser would forego the economic benefits associated with this development.

Comment 10

On what basis was the water depth requirement formulated? How did this determination affect site selection?

Response 10

The water depth requirement was formulated on the basis of the draft requirements of future ships expected to call at the facility if it is constructed. Sufficient draft was one of five mandatory site characteristics in Weyerhaeuser's site selection process. See Section 6.3 and Appendix N for an evaluation of its role in site selection.

Comment 11

The DuPont site would affect as many resources as the Chenault Beach and Hawks Prairie alternatives (p. 168, paragraph 2, and Table 17, DEIS). If "major waterfowl area" were added to Table 17, DuPont would have more affected resources.

Response 11

Table 32 and Section 6.4.5.3 have been modified to reflect this comment.

Comment 12

The EIS should include the Policy Statements on Ports and Water-related Industries from the state Shoreline Management Act.

Response 12

They are included in Section 3.1.1 of this FEIS.

Comment 13

How did economics aid Weyerhaeuser in the choice of alternatives? Why wasn't leasing of a private port considered?

Response 13

See Section 6.3 and Appendix N for a description of Weyerhaeuser's site selection process. Site selection was based on the capacity of the various sites to satisfy various site criteria. Design alternatives were included with one requirement that they be cost-effective. It should be noted that the environmental impact assessment does not consider the applicant's cost factors which are proprietary information of Weyerhaeuser Company. Some of the 29 alternative sites originally investigated by Weyerhaeuser were privately owned sites. However, none of those sites met the selection criteria of the Company (Section 6.3 and Appendix N).

Comment 14

The alternative of locating the dock at Solo Point needs to be analyzed.

Response 14

This analysis was performed after release of the DEIS and is addressed below. Basically, the environmental assessment comparing two dock locations near Solo Point with the proposed dock location near Sequalitchew Creek indicates some environmental advantages associated with the Solo Point site. The Solo Point location would be a greater distance from the Nisqually Delta and would avoid impacts to Sequalitchew Creek Canyon. Other comparisons favor the proposed location. Most significant is the incompatibility of locating the dock at Solo Point with Fort Lewis' shoreline training exercises and extensive recreational uses that occur in the Solo Point area. The Department of the Army's decision not to approve a lease of real property to Weyerhaeuser precludes Solo Point as a viable alternative dock location (Appendix O).

Description of the Solo Point Alternatives

Two alternative dock locations near Solo Point were identified for an engineering feasibility analysis (KPFF, 1980). Other alternative locations might be possible at, or near, Solo Point, but these two suggested locations are probably representative of other possible locations, and, therefore, are used to analyze the suitability of the Solo Point area.

Figure Q-1 presents the locations of the two dock alternatives. Both docks are similar in overall design to the proposed dock (Chapter 1). Alternative I requires no construction dredging and is located approximately 750 feet from the shoreline at the 60-foot depth contour. Alternative II is 250 feet from the shoreline in 30 feet of water and requires construction dredging of about 180,000 cubic yards of material and a suitable disposal site.

Access to the Solo Point dock location from the upland terminal crosses Fort Lewis land through a narrow corridor between Lone Star property and the Fort Lewis sewage treatment plant, according to a suggested route provided by Weyerhaeuser (KPFF, 1980). Other possible routes involve greater travelling distances and involve substantially similar environmental features.

A bluff, approximately 200 feet high, must be descended by the access road to the Solo Point dock locations. Alternatives for the access road include open cut, cut and cover, and tunnel designs. An overpass across the Burlington Northern tracks is required by each design to provide access to the trestle and dock. An underpass is not possible because of a lower railroad grade in the Solo Point area than in the Sequalitchew Creek area where an underpass is possible.

Environmental Impacts of Solo Point Alternatives

Potential environmental impacts associated with the Solo Point alternatives are discussed below. Frequent comparisons are made with the expected impacts of the proposed dock and access road near Sequalitchew Creek.

Land Use/Zoning - The shoreline from DeWolf Bight, west of the Nisqually Delta, to Tatsolo Point, northeast of the delta, is designated as a shoreline of statewide significance (Section 3.1.1). The proposed dock location is within this designated area. The Solo Point dock locations are outside this designated area. However, commercial shipping facilities are not prohibited in shorelines of statewide significance or given any higher priority in other shorelines. Thus this difference is not considered relevant under state law. The shoreline at Solo Point is, however, classed as a Conservancy Shoreline according to the Pierce County Shoreline Master Plan Program, 1974 (Section 3.1.1.1). The proposed dock location is within the City of DuPont "Urban" designation where commercial docks are permitted. Thus the Solo Point alternatives are not consistent with the current shorelines master program (which is the state's program) whereas the Sequalitchew Creek location is.

The proposed dock site is zoned "Industrial" by the City of DuPont while the Solo Point sites are zoned "General" by Pierce County. Commercial docks are allowed under either classification.

Weyerhaeuser presently has an agreement with Burlington Northern Railroad to make overcrossings and undercrossings of the tracks in the vicinity of Sequalitchew Creek. No such agreement exists for the Solo Point site, although it may be possible to negotiate such an easement.

An underpass is preferred by both Weyerhaeuser and Burlington Northern because of less operational risk, liability, and safety concern compared to an overpass (KPFF, 1980). An underpass is possible at Sequalitchew Creek, but not at Solo Point due to a lower railroad grade at the latter site.

At the Sequalitchew Creek location the access road and dock would be located entirely on Weyerhaeuser property where railroad crossing rights already exist. Access to Solo Point would be largely across Fort Lewis lands. No railroad crossing rights exist and the dock and trestle would be on Fort Lewis tidelands. It is possible that railroad crossing rights could be negotiated with Burlington Northern. Reversionary rights to Fort Lewis lands not used for military purposes are owned by Pierce County. Whether or not these rights could be exercised is unknown.

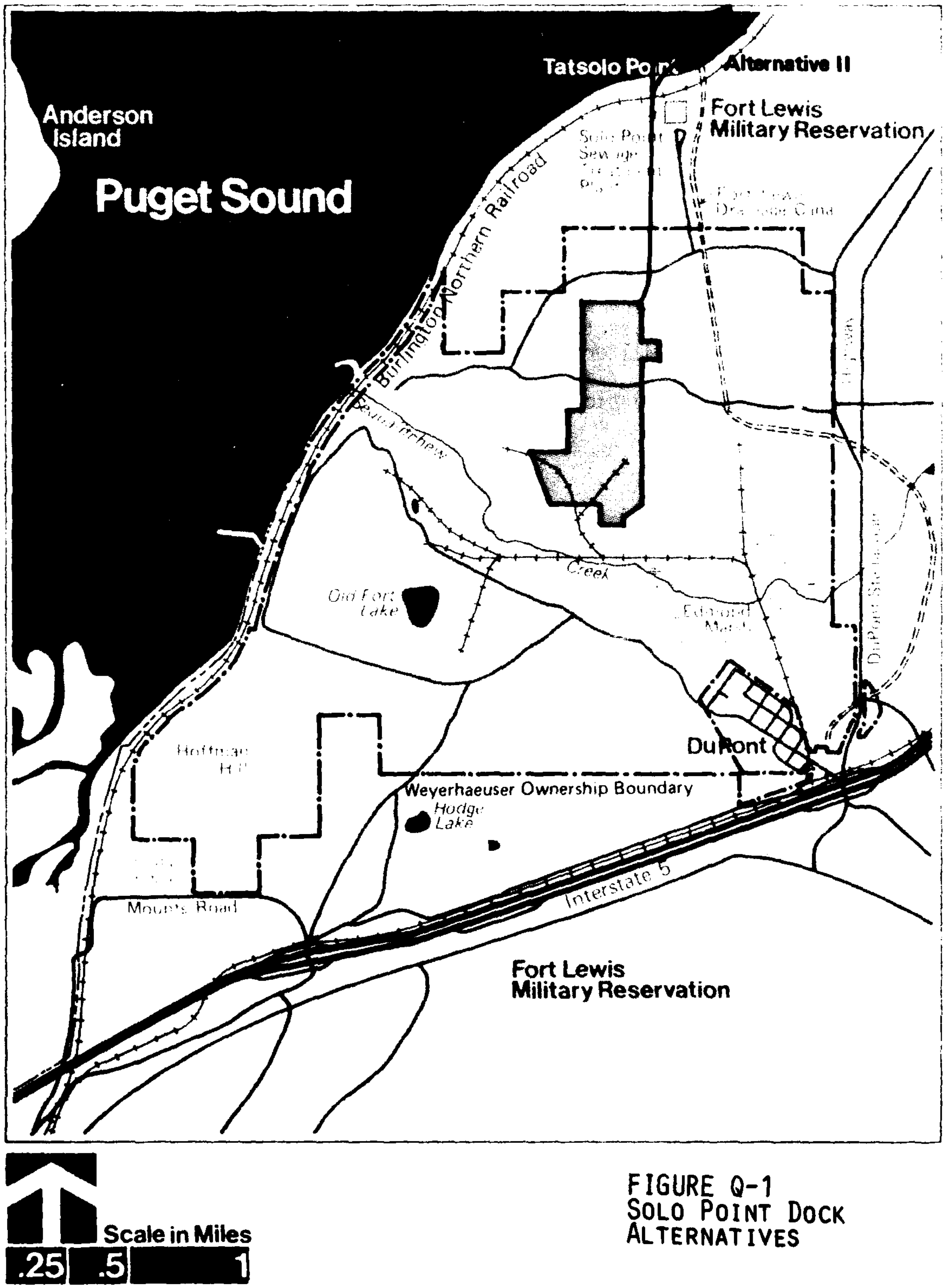


FIGURE Q-1
SOLO POINT DOCK
ALTERNATIVES

The access road to Solo Point would also transect three Fort Lewis roads and an easement granted to Lone Star Industries. Adverse traffic impacts would result.

Conflicts with amphibious shoreline training exercises and recreational activities at Solo Point would arise, according to a letter from the Deputy Installation Commander at Fort Lewis (dated 12 June 1980 in Volume II, Appendix O). As a result, the Army would probably not approve of an easement or lease that would allow Weyerhaeuser to locate at Solo Point.

Earth/Topography - Because of its steep grade, the bluff above the Solo Point dock locations is unsuitable for road construction. The presence of Kitsap formation makes the bluff unstable for construction purposes and prone to landslides (Walter and Kimmel, 1968).

Considerable excavation would be required for all three road access alternatives (Table 1).

TABLE 1

EXCAVATION VOLUMES REQUIRED FOR
ROAD ACCESS ALTERNATIVES AT SOLO POINT AND SEQUALITCHEW CREEK

Location	Road Access Design	Cubic Yards Excavation
Solo Point	Open Cut	2.0 million
	Cut and Cover	1.8 million
	Tunneling	0.2 million
	Sequalitchew Creek	0.31 million
Sequalitchew Creek	Reinforced earth/retaining wall	

Source: KPFF, 1980

A wide range in required excavation is evident from this comparison. Disposal of these materials is also necessary and may be accompanied by adverse impacts, the nature of which would depend on the locations selected. In any of the Solo Point access road alternatives except tunneling, the amount of excavation required would be much greater than that required near Sequalitchew Creek. Tunneling would be considerably more expensive.

Dredging would be necessary with Solo Point Alternative II if it were selected. Disposal of dredged material have potentially adverse environmental impacts. Solo Point Alternative I would not require dredging; however, the dock would be located 750 feet from the shoreline, 500 feet farther from shore than either Solo Point Alternative II or the proposed dock location at Sequalitchew Creek.

The suitability of underlying strata at Solo Point for the construction of the dock and associated trestle is unknown. Hart, Crowser and Associates, Inc., (1976) have identified homogeneous, fine sediments south of the Sequalitchew Creek dock location that may be prone to liquefaction in a seismic event. Liquefaction of bearing strata in this area could result in vertical and lateral displacements of a dock and trestle, which could be structurally damaging.

It is possible, though presently unknown, that similar sediments exist at Solo Point. Further geotechnical investigations would be necessary before Solo Point could be considered a feasible alternative.

Energy - Table 2 indicates that operational fuel consumption for vehicles transporting logs and forest products from the upland terminal area to the docks would be 1.4 times greater with the Solo Point sites than with that for the proposed site. This difference is due to the 1/3 mile additional distance to Solo Point (KPFF, 1980).

Fuel consumption during construction would also be greater at Solo Point than at Sequalitchew Creek due largely to the requirement for more energy intensive construction methods.

TABLE 2

MATRIX OF ENERGY CONSUMPTION

Operation	Proposed Site Sequalitchew Creek "Reinforced Earth"	A "Open Cut and Bench"	B "Cut and Cover"	C "Tunneling"
Proposed Site	1.0	N/A	N/A	N/A
Solo Point Site I	N/A	1.4	1.4	1.4
Construction				
Proposed Site	1.0	N/A	N/A	N/A
Solo Point Site II	N/A	1.20	3.1	4.0

Source: KPFF, 1980.

Water Quality - Locating the dock at Solo Point rather than at the proposed Sequalitchew Creek site would place the dock nearly two miles farther from the Nisqually Delta and the Nisqually National Wildlife Refuge boundary. In terms of the Delta, more time would be afforded for dispersion or containment of contaminants should a spill occur at Solo Point. However, less time would be available for containment of a spill before it reached Ketron Island and adjacent shorelines, including the City of Steilacoom.

The degree to which potential impacts on the Nisqually Delta would be reduced would depend on such factors as wind direction, tidal action at the time of the spill, and the effectiveness of containment and dispersion.

Construction related impacts on water quality at Sequalitchew Creek would be eliminated by locating the dock and access road at Solo Point. However, those impacts would be shifted to the Solo Point site. No creek mouth occurs at the Solo Point location.

Noise, Visual, Aesthetics - The increased distance from Solo Point to the Nisqually Delta would also reduce potential noise-related disturbances to wildlife in the Nisqually Delta area.

As distances from Solo Point to noise receptors on Anderson Island would be greater, a slight decrease in noise-related impacts on Anderson Island would be expected.

The facility at Solo Point would still be visible from Anderson Island, but would not be visible by direct line-of-sight from the Nisqually Delta. On the other hand, distances from Solo Point to Ketron Island and Steilacoom would be less, introducing noise and visual impacts to more heavily populated areas.

TABLE 3

DISTANCES FROM LANDMARKS NEAR STEILACOOM TO
SOLO POINT AND SEQUALITCHEW CREEK

	Solo Point Site	Sequalitchew Creek Site
From Gordon Point, Steilacoom	2.5 miles	4.5 miles
From Southside Ketron Island	0.7 mile	2.3 miles

Source: KPFF, 1980.

Flora and Fauna - Adverse impacts on flora and fauna of the Sequalitchew Creek Canyon would be precluded by locating the dock and access road at Solo Point. Also, the access road to Solo Point would involve destruction of wildlife habitat considered to be of relatively lesser quality to that found in Sequalitchew Creek Canyon.

Impacts on marine resources near Sequalitchew Creek would be precluded with the Solo Point alternative. These resources are described in Section 2.8. The marine resources near Solo Point are less well known, but they are

expected to be similar to those in the vicinity of the proposed dock. Thus, impacts on marine resources there would be similar to impacts expected on marine resources in the proposed project vicinity.

As a result of the greater distance from Solo Point to the Nisqually Delta and because of the shielding effect of Tatsolo Point, disturbance to delta wildlife, due to noise, oil spills and other factors would be minimal.

Navigation - Location of the dock at Solo Point would decrease offshore water space available for maneuvering ships that would call on the facility. At Sequalitchew Creek, approximately 7,400 feet are available between the proposed dock location and Anderson Island. By comparison, the distance between Solo Point dock Alternative I and Ketron Island is approximately 2,700 feet.

The passage between Solo Point and Ketron Island is used for recreational boating, sportfishing, and commercial fishing. Amphibious military training exercises also occur. The potential for adverse impacts on this traffic is high if the export dock would be located at Solo Point.

Indian Fishing - Locating the dock at Solo Point would place the dock just outside the salmon milling area shown in Figure 32 of the FEIS. By contrast, the proposed dock at Sequalitchew Creek is within the milling area. The Solo Point area is within the Nisqually Tribe harvest area, as is the proposed dock location. Because Cormorant Passage is relatively narrow, greater potential interference with Indian fishing would be expected with the dock at Solo Point.

D. PORT PROLIFERATION

Comment Letters: 16,18,32,34,35,36,37,38,39,51,66,70,80,89,92

Comment 1

The proposed project is incompatible with federal (Coastal Zone Management Act), state (Shoreline Master Program, Marine Land Use Policies Department of Natural Resources), and regional (Puget Sound Council of Governments) policies. These policies discourage the proliferation of private ports for individual interests and encourage the use of existing ports or the development of new ports in already developed areas. The relationship of the facility with the Washington State Marine Land Use Policies, which require future port development to take into account state and national needs for new facilities, should also be discussed in this context.

Response 1

These shoreline and coastal zone policies as related to the proposed project are discussed in Section 3.1.1 and 3.2.2. Refer to Section 1.1.1 (Volume I), Appendix B (Volume II), and Appendix Q, Section A (Volume III), for discussions related to public benefits from the proposed project. The Washington Department of Natural Resources (WDNR) will have to decide whether the use of the dock is a continuing use or new use. If it is a new use, then WDNR would have to investigate whether an existing port could accommodate the Weyerhaeuser facility.

Comment 2

The project establishes a precedent of changing public policies to allow development for private gain. The effect the precedent would have on future industrialization of Puget Sound's shores for ports and the impact of proliferating private ports on Washington's public ports should be addressed.

Response 2

In 1972, before Weyerhaeuser considered buying the DuPont property, the City of DuPont proposed and WDE approved an "Urban Environment" designation for a portion of the DuPont shoreline where the DuPont Company had a dock. Commercial shipping facilities, such as the export facility, were allowed under this designation. Several years ago, Weyerhaeuser proposed to relocate this urban designation somewhat farther from the Nisqually Delta, but with no expansion of the amount of area designated urban. However, the urban designation has not been relocated, so Weyerhaeuser has proposed to construct the dock entirely within the original "urban" area. In either case there would be no precedent for allowing a commercial shipping use outside an area specifically designated for this purpose. Only a small percentage of the shorelines are designated as urban.

Approval of this project would not commit an agency to approve commercial shipping facilities at other sites. Under state and federal environmental laws, each project is analyzed on its own merit. Cumulative impacts with all prior projects are normally considered in individual project EISs and through various standards for ambient air, water, and noise conditions.

Commercial shipping facilities in Washington have never been confined to major public port areas. The State Department of Natural Resources has leased second class tidelands, shorelands, and beds of navigable waters abutting them, for commercial shipping operations in numerous non-port locations. (By definition, "second class" tidelands and shorelands are more than two miles from any city limits.) Many commercial shipping facilities, such as the existing DuPont wharf, are located in small towns, not generally thought of as "traditionally recognized port areas." Besides the former DuPont Company operations at this site, current examples in southern Puget Sound include the Weyerhaeuser log dump at South Bay (Henderson Inlet) near Olympia, gravel mining operations near Steilacoom, and the Simpson Timber operations at Shelton.

<u>Comment 3</u>

The report by Washington Sea Grant Program, Port Expansion in the Puget Sound Region, October 1972, is recommended.

<u>Response 3</u>

Acknowledged. The document has been reviewed.

E. LAND USE

Comment Letters: 11,16,18,29,31,32,34,35,36,37,38,39,40,51,52,56,58,59,60, 61,68,70,73,76,77,85,88,89,92

Comment 1

The EIS should include the position letter from the Washington State Department of Fcology, written by John Biggs on June 11, 1975. The letter condition;.ly approved the urban designation of the dock area and creek, but expressed concern over future development of the site due to proximity to the delta.

Response 1

The DuPont Shoreline Master Program was approved by the Washington State Department of Ecology. The approval letter did caution the City of DuPont to carefully consider all reasonable measures that might protect the wildlife refuge and if the city issued permits for the types of development authorized in the urban environment. A copy of the letter dated June 11, 1975, is included in Appendix J.

Comment 2

How the proposed development complies with the spirit and letter of federal, state, regional, and local land use policies needs to be addressed. Its relationship to the federal Coastal Zone Management Act, the state Shorelines Management Act, the Puget Sound Council of Government's regional land use policies, Pierce County's Shoreline Master Plan, and DuPont's zoning should be clarified. The relevance of the area's designation as an "area of particular concern" under the federal program and a "shoreline of statewide significance" under the state program and how the use preferences of the state act are met should be addressed.

Response 2

The FEIS has been modified to specifically reflect these issues. Refer to Chapter 3, Volume I, of the FEIS.

Comment 3

Although the dock area is categorized urban land-use within the state shoreline management program, the designation was based on historical usage. The compatibility of Weyerhaeuser's proposed usage, which represents a substantial increase in activity, with adjacent natural and conservancy shorelines and with the intent of the state shoreline program is questioned.

Response 3

It is acknowledged that the proposed project would be an intensification of existing shoreline activity that may not be entirely compatible with adjacent shoreline uses. Proposed mitigation, such as described in the FEIS,

should lessen project incompatibilities. As stated in the FEIS, the Washington Department of Ecology has determined that the project is in compliance with the Shoreline Management Act and the Coastal Zone Management Act.

Comment 4

The project would set a precedent of changing public planning and environmental protection policies to suit private needs. Once an activity center is established on the site, further development becomes easier because the site becomes an existing activity center. See also the discussion on Port Proliferation.

Response 4

See Section 1.6 of Volume I, as revised, and Comment/Response Section D, response 2 which deals with the question of port proliferation.

Comment 5

Is the Comprehensive Planning Study of Annexation (1971), which contains DuPont's present land uses and proposed zoning, an official comprehensive land-use plan? If so, what provisions would directly or indirectly affect fish and wildlife resources?

Response 5

The comprehensive planning study of annexation (1971) was utilized by the City of DuPont in deciding to annex and zone the DuPont property in 1971 and 1972 and is still in effect. The study does not contain all elements of what is traditionally defined to be a comprehensive land use plan which the City is now planning to prepare. The planning study does not discuss fish or wildlife resources.

Comment 6

The EIS should clarify Weyerhaeuser's ownership of tidelands within the Nisqually Reach and Delta.

Response 6

Refer to Section 3.1.1.2 for discussion of tideland ownership. Weyerhaeuser owns second class tidelands in front of their property (except those of the Nisqually Wildlife Refuge).

Comment 7

DuPont's jurisidiction over a considerable portion of the refuge should be explained. It should be pointed out that the city's adopted shoreline master program does not cover this area of jurisdiction, but it is covered by the Pierce County shoreline master program. Clarification is needed on the extent of these jurisdictions over the site and the refuge.

Response 7

Pierce County has jurisdiction over a part of the refuge as shown in the FEIS (Figure 46). The City of DuPont's incorporated limits extend to the middle of the water body. The USFWS must consider the DuPont Shoreline Master Program under the "consistency" clause of the CZMA if it ever desires to undertake any development in this part of the refuge.

Comment 8

Now that the City of DuPont has annexed the Lone Star property, do city limits extend into the sound? If so, should a harbor area be established in front of the city?

Response 8

Refer to revised Figure 43. The annexed portion includes city authority over the adjacent waters of Puget Sound. A harbor area need not be established; the State Department of Natural Resources can issue a bedland lease for the proposed project to proceed without establishing a harbor area (WAC 332-30-112).

Comment 9

Has Nisqually Delta been designated a wetland of importance?

Response 9

Yes. The Nisqually Delta is considered to be a wetland of importance.

Comment 10

A comprehensive estuary plan for the Nisqually Corridor and Delta from Mt. Rainier to the Delta to Tatsolo Point and DeWolfe Bight should be undertaken for optimum impact analysis and decision-making.

Response 10

This EIS analyzes only the project site and the surrounding area which could likely be impacted by development of the proposed facility.

Comment 11

A statement about the National Natural Landmark registry on the delta should be part of Section 3.2.4.5. It should state when and why the status was given and its significance as a protection measure for the delta. Its boundaries and jurisdiction should be clarified.

Response 11

Section 3.1.4.5 has been revised to identify that the Nisqually Delta was designated as a National Natural Landmark in 1971 by the U.S. Department of Interior. Figure 44 describes jurisdictional authority and boundaries of the Delta area.

Comment 12

The EIS fails to comment on state requirements that a harbor area and harbor lines be established before permitting the project.

Response 12

Refer to response 8 of this section.

Comment 13

The EIS states that the State of Washington will review the project's compliance with the federal Coastal Zone Management Act. It should be noted that federal permits cannot be issued until this review is made.

Response 13

The FEIS has been modified to discuss this. Refer to Chapter 3 of the FEIS.

Comment 14

In Section 3.1.2.2., the discussion of two parcels of land under the jurisdiction of Pierce County adjacent to the site should mention that both parcels are subject to the policies and use regulations of the state and federal shoreline management programs.

Response 14

Agreed. This information is presented in Section 3.2.2 of the FEIS.

Comment 15

There should be more discussion of the wildlife refuge and its relationship to land-use planning. Some questions that should be answered include:

15a. What management and enhancement goals were stated when the refuge was created?

Response 15a

The FEIS has been modified to include the goals and plans for the Nisqually National Wildlife Refuge (Chapter 3). Refer to Section 3.1.2.4.

15b. Does a comprehensive plan for the refuge presently exist?

Response 15b

Yes, a plan exists and the FEIS has been modified to describe the comprehensive plan (Chapter 3).

15c. What is the nature of the planning mentioned in 3.1.4.5, and when would it be completed?

Response 15c

Section 3.1.2.4 of the FEIS discusses the current Nisqually National Wildlife Refuge Conceptual Plan in detail.

15d. What lands might be proposed for acquisition?

Response 15d

The boundaries of the refuge shown in both the draft and final EIS include their proposed ultimate acquisition. The Weyerhaeuser site is not part of the acquisition plan.

Comment 16

How land-use controls could really work in light of past failures should be explained.

Response 16

Zoning, shoreline master plans, comprehensive land-use plans, and master plans are and have been effective methods of control. Amendments changing such plans are allowed by following the necessary planning procedures (including the EIS process). Changes in such plans typically reflect changes in policy decisions and should not be considered as failures.

Comment 17

The DEIS indicates the proposal is a historical continuation of industrial uses, but DuPont Company used less than 10 percent of the site.

Response 17

The proposed Weyerhaeuser export facility, like the prior DuPont operations, would occupy less than 10 percent of the site. If the City had considered the DuPont Company operations a unique land use that was not to be expanded or replaced by other industrial uses, it could have:

a. zoned the area for a less intensive land use with the explosives operations recognized as a "non-conforming use", or

b. established a special zone to accommodate that particular use, such as an "explosives manufacturing" or "hazardous operations" zone, or

c. required conditional use permits for most types of industry within the "industrial" zone.

Instead the city adopted zoning provisions allowing a wide variety of industrial uses without conditional use permits. This was done in 1971 when the then existing DuPont explosives manufacturing facilities were already largely obsolete and known to have a limited remaining useful life according to representatives from the City of DuPont.

Comment 18

Please discuss the types of industrial development allowed and applicable restrictions of the industrial zoning.

Response 18

Essentially, all types of industrial use are permitted. Specific uses and restrictions are set forth in detail in the City of DuPont zoning ordinance.

Comment 19

How does the project conform to use preferences 1 through 7 of the Washington Shorelines Management Act regarding allowable uses of a shoreline of statewide signficance?

Response 19

The FEIS has been modified to include the conformance with policies for a shoreline of statewide significance. Refer to Section 3.1.1 of Volume I.

Comment 20

With reference to Section 3.1.4.5 of the DEIS, the USFWS does not own either the Delta or National Natural Landmark.

Response 20

Section 3.1.4.5 states that the Delta is operated by the USFWS.

Comment 21

The land within the refuge is in both natural and conservancy categories in Figure 48.

Response 21

The FEIS has been modified accordingly. Refer to Figure 48 of Volume I.

Comment 22

Many figures say that the DuPont shoreline includes second class tidelands; there is no definition of these in the glossary or the text.

Response 22

Second class tidelands are lands owned by the state and are located between ordinary high tide and the line of extreme low tide more than two miles (along high water line) from any incorporated city.

The State sold second class tidelands to the DuPont Company and Lone Star Company before the City of DuPont was formed. These lands have subsequently been sold to Weyerhaeuser. Although technically the tidelands may be unclassified after they pass into private ownership, such tidelands customarily are referred to as "second class" even though they are privately owned.

Comment 23

Political impacts should be mentioned. The FEIS should describe the climate of the administration, history of the effects to preserve the Delta, efforts to protect the south Sound and Nisqually corridor.

Response 23

The EIS deals with data, laws, regulations, and adopted plans. It does not speculate as to the political climate. The Nisqually Delta and its importance is addressed in the EIS.

F. MITIGATION

Comment Letters: 1,6,10,16,18,19,22,32,34,39,56,61,73,76,77,81,84,85,89,92,96

Comment 1

The EIS should detail mitigation plans, monitoring plans, and limitations on construction and operation. Enforcement measures and Weyerhaeuser's commitment to them should be carefully defined. Cumulative and long-range effects of mitigation measures and operations should be considered. Mitigation should include methods to protect water quality, fisheries, wildlife, wildlife habitats, aesthetics, and cultural resources.

Response 1

Mitigating measures committed to by Weyerhaeuser and/or set as permit conditions in the City of DuPont's shoreline management Substantial Development Permit are identified in each subsection of Chapter 4. Additional mitigating measures that are being considered by the Corps of Engineers are identified as well. The EIS summary also lists mitigating measures derived from Chapter 4. In addition, Sections 1.6 and 3.2 describe the Memorandum of Understanding (MOU) negotiated between the U.S. Fish and Wildlife Service (FWS) and Weyerhaeuser Company that limits development of the site and provides a degree of protection for sensitive habitats. This MOU is expected to be signed after the FEIS has been reviewed by FWS.

Comment 2

More detailed plans for the sewage treatment plant on the dock and the holding tank under the dock are needed.

Response 2

Detailed plans are not available. Sewage treatment facilities would not be constructed on the dock. The City of DuPont requires upland treatment and disposal of dock sanitary wastes. Stormwater on the dock would be collected in the holding tank and treated before discharge. Water quality impacts from this discharge are expected to be insignificant.

Comment 3

How would a spill on the dock access road be handled?

Response 3

A spill contingency plan would be submitted to the Coast Guard and EPA for review prior to construction and again prior to operational start-up. Details of prevention, containment, and clean-up of spills would be contained in the spill contingency plan. Refer to Appendix M.

Comment 4

Was the Water Resource Inventory for Washington State used for all periods of intensive rainfall to determine capacity of the dock stormwater and water collection system.

Response 4

See Section 1.3. The stormwater collection system would be large enough to detain runoff from the dock and dock-access road during the most intense 30-minute period of rainfall expected in 25 years. According to the National Weather Service, this rate is 0.8 inches/30 minutes.

Comment 5

How would monitoring to detect groundwater contamination be conducted and enforced and what criteria would be used?

Response 5

See Section 4.5.2 for a discussion of groundwater monitoring. Groundwater would be monitored as required by health regulations, by the City of DuPont's Shoreline Permit, and by the agreement between Weyerhaeuser, WDE, and the City of DuPont discussed in Section 3.2 of Volume I.

Comment 6

What enforcement procedures would ensure prohibition of discharges of sanitary sewage, ballast, etc., from the ships?

Response 6

Ship discharges of sanitary sewage ballast tanks, and bilge water are controlled by Coast Guard regulations. Ballasting of clean sea water would occur during loading operations at the dock. No pumping out of the ship's sewage holding tanks would occur at the dock. Bilge water also would not be discharged at the dock.

Comment 7

What provisions would be made for enforcement of water quality monitoring for protection of the Delta?

Response 7

The agreement between Weyerhaeuser, Washington Department of Ecology (WDE), and the City of DuPont (Section 3.2) requires Weyerhaeuser to monitor surface water quality at its boundary adjacent to the refuge in accordance with a monitoring plan satisfactory to the WDE for a period of three years after completion of construction.

Comment 8

A bridge completely spanning the creek, rather than culverts, and bridges rather than a fill or culverts at road and rail accesses, especially on unstable Kitsap formations would result in fewer environmental impacts and aid animal movement on the site.

Response 8

Weyerhaeuser is currently planning an open arch culvert crossing which leaves the stream bottom undisturbed. A Hydraulic Permit would be required for the construction of the creek crossing. This assures coordination with the Departments of Fisheries and Game such that construction impacts are minimized. Use of the open arch culvert crossing would allow a natural stream bottom. No barrier to movements of aquatic benthic organisms or fish would be expected.

Comment 9

How can the the loss of 169 acres of habitat be mitigated by habitat enhancement elsewhere?

Response 9

Mitigation programs could be developed to provide public access to portions of the shoreline, buffer strips for marshes and wetlands, selective changes of zoning and shoreline designations to protect wildlife habitat, and habitat improvement at the old DuPont facility. Some of these programs are part of the U.S. Fish and Wildlife Service-Weyerhaeuser Memorandum of Understanding (MOU) which is expected to be signed after the FEIS has been reviewed by FWS. See Sections 1.6, 3.3, and Appendix K.

Comment 10

The final EIS should contain a commitment to paving or building stairs to eliminate erosion from the path down the bluff.

Response 10

The City of DuPont has specified in its Shoreline Management Substantial Development Permit (issued February 18, 1981) that the path down the bluff shall be improved and maintained to the extent the city determines is reasonably necessary to minimize erosion.

Comment 11

Damage to oak savannah habitat of the rare western gray squirrel from the road and rail access routes should be minimized, perhaps by rerouting.

Response 11

The proposed U.S. Fish and Wildlife Service-Weyerhaeuser MOU sets aside part of the area containing the "Oak Savannah" vegetation type as a study area. Although these lands are being held for possible development, in the interim they would be held for wildlife research. If Weyerhaeuser wishes to terminate the wildlife study area designation, notification 12 months in advance in areas under wildlife study, and three months in any other areas described as Wildlife Study Area in the MOU, must be made to the U.S. Fish and Wildlife Service. This MOU does not conserve this habitat indefinitely; however, the access route avoids most Oak Savannah areas.

Comment 12

Removing the old dock and driving piles for the new one should be avoided during March through June to avoid increased turbidities affecting juvenile salmon outmigration.

Response 12

These activities would be avoided between March 15 and June 15. Section 4.5.4 has been modified to include this statement.

Comment 13

Mitigation for both large and small oil spills should be detailed, with guarantees that they would be enforced.

Response 13

Refer to Appendix M concerning the contents of oil spill contingency plans. Enforcement is mandated by the Coast Guard.

Comment 14

Need more detail on how the dock access road would be modified to permit animal movement.

Response 14

No modifications are planned to provide for animal movements across the dock access road.

Comment 15

Why not keep rights-of-way clear by planting low groundcover rather than by energy-consuming mechanical means?

Response 15

Low maintenance plantings that resist intrusion by undesirable species would be used wherever possible.

Comment 16

An environmental board should be established to determine suitable mitigation efforts and the effects of long-range adverse impacts.

Response 16

One purpose of the NEPA EIS process is to identify potential mitigation which could be incorporated as conditions in the Corps of Engineers' Section 10 Permit. The Corps of Engineers will consider all proposed mitigating measures during the permit evaluation process, and identify additional measures that could be added as conditions.

Comment 17

If no mitigation were possible and damages were severe to individuals and fisheries, would Weyerhaeuser pay the awards of compensation?

Response 17

Individuals or organizations could certainly claim compensation through normal legal channels.

Comment 18

The proposed facility should be evaluated in light of its worst possible impacts, without the suggested mitigation measures, as well as in light of possible mitigation.

Response 18

There is no need for this based on the criteria for the preparation of environmental impact statements published by the Council on Environmental Quality. Impacts of the proposed facility have been assessed in terms of the "worst case" when data/information has not been available. Where specific data/information has been available, assessments have been based on a "most likely" case.

Comment 19

What mitigation is proposed to protect wildlife from noise and operational activity?

Response 19

See the discussion of the U.S. Fish and Wildlife Service-Weyerhaeuser MOU described in Sections 1.6, 3.2, and Appendix K.

Comment 20

Weyerhaeuser should commit itself to more defined, permanent buffer zones.

Response 20

See the discussion of the U.S. Fish and Wildlife Service-Weyerhaeuser MOU in Sections 1.6, 3.2, and Appendix K.

G. AIR QUALITY

Comment Letters: 32,34,65

Comment 1

The impact on air quality needs further discussion. The potential for pollution resulting from a combination of topography, weather, and proposed operations should be addressed. Changes in air quality and odor based on future development of the site should be quantified and compared with existing levels.

Response 1

Changes in ambient air quality have been addressed in detail (Appendix C). Modeling employed to evaluate the potential impact from the proposed facility included climatological data. Future development of the site beyond that which is proposed is impossible to predict. Therefore, future changes in air quality cannot be assessed.

Comment 2

Under Unavoidable Adverse Impacts, what standards would the increased emissions stay within?

Response 2

The increased emissions would stay within the Washington State ambient air quality standards.

Comment 3

How would the increase in airborne wood fibers affect neighboring communities?

Response 3

No effect is anticipated. No wood fibers would be present in airborne emissions.

Comment 4

It appears that calculated emissions of shiploading are inconsistent with similar operations and with proposed levels of operation at the site described elsewhere.

Response 4

The calculated emissions are consistent with both of these.

H. WATER QUALITY

Comment Letters: 7,16,18,22,32,34,35,53,56,61,77,79,92

Comment 1

The discussion of the impact of contaminants on water quality is insufficient. Quantitative data is needed on flushing rates and potential sources, types, and levels of contaminants. Contaminants considered should include petroleum products, heavy metals, construction materials, runoff from construction and operations activities, and ship cooling water emissions. Sources should include the terminal area, log storage area, upland sites, dockside area, and dock access road. The relationship and effectiveness of flushing and dilution to these contaminants should be discussed more thoroughly in light of the quantitative data. The impact of chronic low-level contaminant buildup on water quality should also be addressed.

Response 1

Water quality discussions in Sections 2.5.2, 2.5.3, 4.5.2, and 4.5.4 of the FEIS have been modified to reflect these concerns.

Comment 2

The EIS should deal specifically with the issue of groundwater contamination. Monitoring of shallow groundwater, especially within the terminal area, should be considered to evaluate effects on groundwater and surface water environments. Springs and groundwater seepage, as important sources of inflow to Sequalitchew Creek, should be identified and discussed. The volume of water they contribute to the creek and the adequacy of the proposed 3-inch weepholes in the retaining wall should be quantified. Because the exact pattern of groundwater flow is not known, possible impacts on stream biota and water quality from septic tank and landfill leaching should be examined. The relationship of rapid groundwater percolation to heavy industrial use should also be discussed.

Response 2

Groundwater quality discussions in Sections 2.5.1, 2.5.2, and 4.5.2 of the FEIS have been modified to reflect these concerns.

Comment 3

The proposed marine outfall at 90 feet relies on dilution for minimum adverse impact. This outfall sets a precedent for class AA waters in the area. The impact of chronic low-level long-term water quality degradation by cumulative future discharges should be addressed. In particular, possible shellfish decertification should be discussed. The significance of the class AA designation in this area and the permitted uses and policies of this classification should be discussed.

Response 3

The City of DuPont has specified that no sewage may be discharged to marine waters from the docks as originally proposed. Sanitary waters would be trucked or pumped up to the upland septic drainfield. As noted in Section 2.5.4 effluent is discharged from the sewage treatment plant at Solo Point, two miles north of the proposed dock location.

Comment 4

The EIS should contain a full study and evaluation on the quality of the marine habitat and stream areas. Specifically, there is inadequate information on the potential destruction of salmonid rearing and spawing areas by facility construction and oil spills and on the potential for further water quality degradation from future site development.

Specific concerns include:

4a. Even low-level contaminants would build up in the slow-flushing depths and adversely impact the refuge.

Response 4a

The Nisqually Reach experiences a relatively rapid flushing. According to Friebertshauser and Duxbury (1972), Nisqually Reach would flush in less than 56 days, more rapidly than other areas of southern Puget Sound, such as Case and Budd Inlets. Refer to Section 2.5.3 of the FEIS. Section 4.5.4 discusses potential impacts related to low-level contaminants.

4b. Were baseline data on present levels of heavy metals and hydrocarbons collected from sediments of the DuPont shoreline and delta mudflats to enable assessment of future changes?

Response 4b

Yes; they are presented in Section 2.5.4 of the FEIS.

4c. The discussion of water quality impacts should be consolidated in one section. It should include proposed methods of mitigation, treatment, and equipment design.

Response 4c

Section 4.5 has been revised to more clearly delineate water quality impacts. Methods to be used for waste and stormwater treatment are presented as well as other mitigation measures to minimize water quality impacts.

Comment 5

Special problems of mixing, layering, currents, wind movements, tidal action, etc., relative to the one outlet to the Pacific Ocean should be discussed more thoroughly, particularly for the Central Basin. It should be mentioned that very little detailed information is available.

Response 5

Refer to Section 4.5.3 of the FEIS for discussion on marine hydrology relative to the DuPont site. Further information about marine hydrology can be found in the hydrological baseline studies (CH_2M-Hill, 1972).

Comment 6

Because the Delta cannot be physically buffered, special measures are needed to protect water quality. It should be clarified that the Delta extends considerably waterward of the vegetation line.

Response 6

Special measures would be taken to protect water quality. As explained in the EIS, these include:

- disposal of runoff from terminal area via lined pond or infiltration
- trucking of sewage generated at the dock to upland septic system
- treatment of runoff from dock and access road prior to discharge
- development of an oil spill contingency plan

Figure 51 clearly illustrates the boundaries of the wildlife refuge. The Delta is considered to include the mudflats waterward of the vegetation line.

Comment 7

The discussion of freshwater hydrology should include impacts from stormwater diversion during the dry season.

Response 7

See Section 4.5.1 of the FEIS. Planned land application of treated wastewaters should minimize flow changes in Sequalitchew Creek.

Comment 8

The appendix statement regarding wood tropolones appears to contradict the State Department of Game's letter in the draft SEPA EIS.

Response 8

The tropolone discussion has been moved to Section 4.5.2. The Game Department comment referred to a different facility and is thus not necessarily applicable here. As stated in Section 4.5.2, Western Red Cedar is the primary source of tropolones and would make up a very small fraction of the wood products handled at the facility.

Comment 9

How much toxic materials can be expected to enter the ecosystem? What about future development?

Response 9

Sections 4.5.2 and 4.5.4 discuss the discharge levels into groundwater and Nisqually Reach. Levels of toxic materials generated by future development cannot be predicted since the extent of any future development is unknown.

I. FLOOD PLAIN MANAGEMENT

Comment Letter: 67

Comment 1

Permits to upgrade and riprap the dike on the west bank of the Nisqually River and to replace fill on both sides of the river at the bridge poses a flood threat to local farms.

Response 1

These activities are not part of the proposed DuPont export facility.

J. TERRESTRIAL FLORA AND FAUNA

Comment Letters: 9,18,32,34,39,71,77,78,79,87,89

Comment 1

The DEIS deals only superficially with the DuPont facility's impacts on wildlife in the surrounding area.

Response 1

The FEIS contains detailed biological assessments on the bald eagle and the white-topped aster, species that were identified by the Fish and Wildlife Service as listed or proposed for listing according to the Endangered Species Act. Wildlife impact assessments were based on information gathered in baseline studies conducted during 1977 and 1978 on the DuPont site, the Nisqually Delta Wildlife Refuge, and Nisqually Reach. The DEIS was based on this same information with the exception of the biological assessment of the white-topped aster (*Aster curtus*), which was not available at that time.

Comment 2

Despite the DEIS statement (2-38) that "flora on the DuPont site has been drastically altered by human activity", the site as a whole provides a valuable habitat and portions remain still undisturbed by any human activity. As a productive habitat associated with the Nisqually Delta, the area is a significant element in the ecological food chain of the region. The DEIS lacks discussion of general ecological principles and the interdependence of the area. A discussion of the food chain would allow better assessment of the cumulative impact on species composition of the Reach, in the event one element is disrupted.

Response 2

Two new sections, Wetlands (2.8.10) and Ecological Relationships (2.8.11), address these ecological relationships.

Comment 3

Terminology in the section on waterbirds is unclear and confusing. Use of intertidal beach, "Puget Sound," etc., does not clarify where birds were seen and tables provide data only for the wharf area and the 30 m strip along the shoreline. Additional data is vital to assess the impact of the facility on waterbirds. It should include:

a. a more thorough investigation of numbers of birds using the Nisqually Reach and mudflats adjacent to the site

b. effects of construction, ship movements, and contaminants upon bird use of the area

c. possibility of excessive decrease in bird use of region due to repair time for the rediked area to recover from saltwater intrusion

Response 3

The section on waterbirds in the FEIS (2.6.3.2) has been clarified in terms of locations where waterbirds were surveyed in the baseline studies. The baseline studies by Klotz et al. (1978) and Melchoirs and Motobu (1977) provide additional details about the methods and locations of bird surveys. Impacts are assessed on the basis of available data. No further studies are presently planned to provide additional data of the kind suggested in the comment. The proposed project would have no impacts on groundwater that would lead to saltwater intrusion in the Delta.

Comment 4

The DEIS does not explain the importance of the site as a resting place for game birds. Where do they rest? What is the significance of the site as a nesting and feeding place to game and non-game species?

Response 4

According to Melchiors and Motobu (1977), a city ordinance and Weyerhaeuser policy prohibit hunting of game birds on the DuPont site. The site would serve as a refuge for game birds, but would not be managed intensively as such. A list of game birds found on the DuPont site is included in the baseline study. Twenty percent of the birds observed at the DuPont site in the baseline study were game birds; most of these (20 of 24 species listed) are migratory game birds. Productivity information related to the site's significance as a nesting area for game and non-game species is not available. The site's 3,200 acres, much of which is undeveloped serves as important habitat for birds and other wildlife in the DuPont area. The proposed project would eliminate approximately 169 acres of habitat that provides nesting, feeding, shelter, and other life requisites for birds and other wildlife.

Comment 5

Have terminal and transportation corridors been systematically surveyed for unusual species nests, i.e. hawks, owls, etc.?

Response 5

The baseline study (Melchiors and Motobu, 1977) indicated a red-tailed hawk nest in Sequalitchew Creek Canyon. Nests of other "unusual" species have not been located.

Comment 6

Is the terminal area a resting place for eagles? Are eagles looking for food as they fly over? Do they feed on dead animals on the site or beach? The DEIS glossed over the fact that bald eagles feed on the mudflats. Statements about eagles seem unqualified.

Response 6

Feeding, perching, and roosting of bald eagles on the site is addressed in the biological assessment of bald eagles in Appendix E. Bald eagles feed along shorelines, including mudflats. Bald eagles prefer live prey, but will feed on dead animals opportunistically.

Comment 7

The FEIS might note that the oak savannah may support one of the largest grey squirrel populations in the state.

Response 7

This is acknowledged. The proposed Memorandum of Understanding between Weyerhaeuser and the U.S. Fish and Wildlife Service designates this habitat as a study area, recognizing its value as habitat for gray squirrels.

Comment 8

Does damage occur to flats and salt marshes as a result of waves?

Response 8

The Weyerhaeuser ships would not travel past the Delta and would not generate significant wakes in this area.

K. AQUATIC FLORA AND FAUNA

Comment Letters: 16,18,22,32,34,75,76,79,88,89

Comment 1

The DEIS should not misconstrue the significance of the uniform algae population in the Nisqually Reach. Species diversity is a general indication of stability. Therefore, Wisseman's findings of a relative paucity of algal species in the Nisqually, as compared to diverse populations elsewhere in Puget Sound, may actually signify the fragility of the Nisqually Reach.

Response 1

Wisseman et al. (1978) concluded that "The low diversity encountered in the Nisqually Reach area is probably due to a variety of factors, among which salinity, temperature, turbidity, tidal cycles, and substrate characteristics would be of prime importance." The project would not affect those characteristics except for temporary increases in turbidity during construction.

Comment 2

The DEIS should delete further reference to fish propagation facilities at Sequalitchew Creek. The Creek is already used for large numbers of coho, and a small egg box program would not be comparatively economical. Furthermore, there are still unanswered questions on managing the harvest of a small number of returning adult chum.

Response 2

The reference has been deleted.

Comment 3

There is no reference in the text to private oyster lands and geoduck tracts in the area. However, Figure 30 shows the sites and the SEPA FEIS covers the subject.

Response 3

Reference to private oyster lands and geoduck tracts has been made. See Section 2.8.6 of the FEIS.

Comment 4

No concrete facts were established on effects of port facilities on inter-tidal and sub-tidal life in other areas.

There is a lack of evidence for establishing a better biotic community after the pier is built:

- statements were undocumented
- resource listings were scanty

Response 4

Conclusions drawn from other existing sites would be of limited use due to probable differences in ship use, dock configuration, adjacent land use, relative distance from estuaries, etc. Also, there was no contention made that a "better" biotic community would establish after the dock is built. It was only stated that the new dock would increase piling habitat.

L. BASELINE/MONITORING

Comment Letters: 4,5,9,18,32,34,54,61,76,92

Comment 1

The DEIS is deficient in analysis, representation, and collection of baseline data for biological assessment. The result is unwarranted conclusions.

Response 1

Thank you for your opinion. However, the baseline studies are believed to be adequate for analysis in this EIS process. Appropriate qualifications have been made regarding conclusions based on limited available data.

Comment 2

Baseline studies were conducted during a severe drought year. With no second year study, can sampling under such abnormal conditions reflect genuine levels of fish, amphibians, birds, and water quality? The DEIS must adequately identify normal resources before impacts can be determined.

Response 2

It is acknowledged that baseline studies were carried out during a drought year. Sampling at such a time reflects organism numbers and water quality within the normal range of variation. It is not, however, known whether or not these studies reflect values that would commonly be obtained in other years. No further studies are presently planned.

Comment 3

In assessing bird use of the site, only one aerial survey and a one day on-site inspection were undertaken. Although four bald eagles were sighted this was not addressed and should be mentioned. Neither dunlin nor merganser were among birds listed by DEIS, yet they have been recently sighted in the mudflats by others.

A more accurate assessment would:

a. conduct a weekly rather than bimonthly census during April through September, periods of peak migration

b. census mudflats at low as well as high tides

c. extend collection of bird data beyond the DuPont wharf to include Nisqually Reach and the mudflats

d. support statements with complete tables, including dates and numbers of birds

Assessment done by the Corps of Engineers should be included in the FEIS.

Response 3

A full biological assessment concerning bald eagle use of the site has been performed since the baseline studies. The report of this biological assessment may be found in Appendix E of the FEIS. Appropriate discussion has been included in Sections 2.6.8 and 4.6.8. The dunlin has been added to the species list for the DuPont site; the red-breasted merganser is already listed. No further studies have been planned. Assessments recognize limitations in baseline studies and have been qualified appropriately.

Comment 4

The DEIS is misleading and inadequate in its assessment of adverse impacts on juvenile salmonids. The baseline study was not designed to measure the impact of the new dock which would attract migrating juveniles. Stomach sampling from fish caught in seines and townets throughout the area may not be representative of predation in the proposed dock area.

Response 4

Section 4.8.7 of the FEIS has been modified to include these concerns. Qualification of the stomach sampling results has been made.

Comment 5

Heavy metal sampling was conducted only at a depth of -15 meters. Further baseline data should be obtained from shallow areas nearshore, where the cumulative impacts of gradual heavy metal release may affect juvenile salmon and water birds. Depths of -5, and -30 feet are suggested, and should be sampled all along the DuPont shore and jetty area.

Response 5

See Section 2.5.3 of the FEIS for a modified discussion.

Comment 6

There is insufficient data for conclusions about impact on bald eagles. Further investigation is needed regarding baseline regularity and potential for perching and roosting.

Response 6

Since publication of the DEIS, a biological assessment of project impacts on the bald eagle has been carried out under the provisions of the Endangered Species Act of 1973. A purpose of this study was to assess the use of the DuPont site by bald eagles and the availability of suitable habitat. See Appendix E and Sections 2.6.8 and 4.6.8 of the FEIS.

Comment 7

A study of both absolute and relative abundance of birds permits accurate assessment of importance of site to birds. Emlen's methods used in the study are unsuitable for accipters and shorebirds. The DuPont transects are less than the minimum required for the method.

Response 7

Emlen's method (a strip-count transect method) was not used for accipiters and shorebirds in either the DuPont terrestrial ecology baseline study (Melchiors and Motobu, 1977) or the Nisqually Delta terrestrial baseline study (Klotz et al., 1978). Shorebirds and waterbirds were counted using an absolute census methodology. In the DuPont baseline study, a modified strip count method was used for terrestrial birds that involved counting all the birds along a 30 meter strip on either side of the transect. Density was extrapolated from these counts for various habitats. Coefficients of detectability were not calculated as described by Emlen (1971).

Emlen's method calls for transects 5-15 miles long. Transects used in the DuPont baseline study actually measured about 6.5 miles.

Comment 8

The soil survey does not include the 30 acre area adjacent to the pier to be annexed by the City of DuPont. Because this area has an alternative dock access route planned, it should be included in baseline studies.

Response 8

No further soil studies are planned at this time. If that alternative were selected, a detailed soil survey would be conducted during the design phase.

Comment 9

The DEIS contradicts itself and Wisseman et al. (1978) (p. 68) in stating that "no major shellfish concentrations were found in the intertidal area;" see page 127, last paragraph: "significant shellfish and salmon resources are present on the Reach."

Response 9

The report by Wisseman et al. (1978) states that "major shellfish concentrations were not found at any site within the area sampled, although some shellfish occur commonly in some areas." This study was limited to the intertidal area. The Dames and Moore report (1978) examined the subtidal area and reported relatively dense concentrations of geoducks in limited, nearshore areas. Thus, there is no contradiction.

Comment 10

What are the parameters and criteria for detecting groundwater contamination of on-site wells? What constitutes "appropriate action" if saltwater intrusion is observed?

Response 10

See Section 4.5.2 of the FEIS. If wells become contaminated by saltwater intrusion, fresh water for employees on the site would be obtained from other sources. Bottled water would be used for drinking.

M. ECOLOGICAL RELATIONSHIPS

Comment Letters: 18,34,56,79

Comment 1

The EIS needs more information about the ecological functions of the estuary. Quantitative information about contaminants that would enter the estuarine system from construction and operations is needed for adequate impact assessment. Baseline studies were not designed to show interrelationships of the various components and habitats of the environment. Discussion of these interrelationships is needed for complete assessment.

Response 1

Ecological functions of the estuary have been addressed in Sections 2.8.10 and 4.5.4, as revised.

Comment 2

The basic ecological principle (p. 235) that an adverse impact on one species may indirectly impact other species dependent on the first for food should be expanded to include flora and fauna.

Response 2

These interdependencies are discussed in the revised Section 4.8.10.

N. INDIAN FISHERIES

Comment Letters: 4,6,7,34,89

Comment 1

The proposed project places an unacceptably high risk on Indian fisheries, including the salmon resource and fishing boats and equipment. The dock would eliminate 1,300 feet of optimum milling area for salmon gill net operations, an unmitigable impact that the DEIS ignores.

Response 1

Section 4.8.8 of the FEIS has been revised considerably and addresses this impact. The proposed dock location would eliminate/interfere with less gill net operating area than the alternate location. This impact is acknowledged in the FEIS.

Comment 2

The DEIS fails to assess the navigation hazard of the new dock and large vessels on fishermen in the area. The EIS should address the risk to gillnet fishermen and steps to mitigate associated losses.

Response 2

Section 4.8.8 of the FEIS addresses the risk to Indian fishermen in the area. The City of DuPont's Substantial Development Permit requests, as a permit condition, that Weyerhaeuser cooperate with the Nisqually Indian Tribe to determine the likely effects, if any, of the export facility on Indian treaty fishing and to use its best efforts to seek agreement on measures to mitigate any anticipated impairment of their treaty rights.

Comment 3

The DEIS fails to adequately discuss the project's impact on treaty fishing rights. The FEIS should include:

a. A full description of the Nisqually Indian Tribes treaty right to fish at the dock site and vicinity.

b. A full determination of the project's impacts on the operation of the treaty-protected fishery, including its planned enhancement levels.

c. A full study of the project's impact on the quality of the adjacent marine and stream habitats due to inadequate information on the potential destruction of salmonid rearing and spawning areas by construction and oil spills and the potential of further degradation from future development of the site.

Response 3

Sequalitchew Creek and shorelines of and adjacent to the Nisqually Delta are designated as usual and accustomed fishing areas for the Nisqually tribe. Enhancement and treaty fisheries impacts are discussed in revised Section 4.8.8 of the FEIS.

The EIS and its supporting studies presents a great deal of information concerning the potential impact of the project on marine and stream habitats, both on-site and in the Delta area (Sections 4.5, 4.7, 4.8 and Appendix L). No further studies are presently planned.

O. NON-INDIAN FISHERIES

Comment Letters: 4,5,6,16,18,22,32,34,61,75,76,77,89

Comment 1

The DEIS conclusion that the proposed project would have no adverse effects on fisheries is based on incomplete baseline studies and incorrect readings of other studies. The data on fisheries is misleading because it was compiled before the effects of an area enhancement program could be measured.

Response 1

Modifications in the text of Sections 2.8.8, 2.8.9, 4.8.7, and 4.8.8 in Volume I of the FEIS have been made to address these concerns.

Comment 2

The DEIS is inadequate in its discussion of possible detriments to commercial and sports fishing and related economic impacts. It should address:

a. the potential for damage to the area's use for aquaculture.

b. the impacts of fisheries from cumulative long-term effects of lowered water quality and lowered diversity of organisms. Focus should include both present fisheries and the potential for increased commercial fishing in the area.

Response 2

Analysis in Section 4.5 indicates that there would be no significant cumulative effect on water quality from normal project operations. Nisqually Reach diversity of organisms and aquaculture potential should not be significantly affected, except in the immediate vicinity of the dock.

Comment 3

Further investigation is needed to assess adverse impacts on juvenile salmonids. It is misleading to suggest that juvenile chum do not occur at the DuPont shoreline, and it is too early to indicate that salmonid outmigration is predominantly to the west. Previous studies indicate that chum follow closely to the shoreline and that the DuPont shoreline is a significant migratory pathway for juveniles and adults. The DEIS does not give due recognition to the use of the shoreline by coho released by the Department of Fisheries operation in Sequalitchew Lake.

Response 3

Acknowledged. The DEIS was deficient in this area. Clarification of the text (Section 2.8.8) related to juvenile salmonids and migration paths has been accomplished.

Comment 4

The question of predation remains vague. The DEIS should qualify its conclusions. Because Fresh et al. was unable to obtain stomach samplings in the dock assemblages, where salmonids occurred often and in significant number, Fresh's studies are not designed to assess the impact of the dock. It is likely that significant predation would occur at night when dogfish and ratfish move under the pier.

Response 4

The possibility of nighttime predation by dogfish and ratfish has been added to Section 4.8.7. Qualification of conclusions based on Fresh et al. (1979) stomach samples also has been added.

Comment 5

Because some species run only in alternate years, EIS baselines should include studies for at least two representative years.

Response 5

The fish studies (Fresh et al., 1979) were conducted for the greater part of two seasons: March, 1977 - August, 1978. Pink salmon juveniles were caught along the DuPont shoreline in small numbers during both years. According to Fresh et al. (1979), catches in 1977 were somewhat surprising since adult pink salmon spawn primarily in odd-numbered years in Puget Sound.

Comment 6

The DEIS does not mention the geoduck populations in the Reach. See Goodwin (1973) who estimates that 15 percent of all geoducks in southern Puget Sound occur in the Nisqually Reach.

Response 6

Modified Section 2.8.6 discusses Nisqually Reach geoduck populations in more detail.

Comment 7

Mussels have been omitted as dominant epifauna.

Response 7

This is addressed in Section 2.8.3 as modified.

Comment 8

Wording should be changed to indicate the definite presence of starfish and anemones on DuPont wharf pilings.

Response 8

Section 2.8.6.1 includes a modified discussion of starfish and anemones.

Comment 9

Is there an endangered species list for beach organisms in the area?(34)

Response 9

Endangered species in the area are discussed in Sections 2.6.8 and 4.6.8. No listed threatened and endangered beach organisms occur along the DuPont or Nisqually Delta Shorelines.

Comment 10

The exact status of the clam Rhamphidonta retifera is unknown; however, since 1899, living specimens have been found only from Puget Sound to northern Vancouver Island. The DEIS should be modified to say the clam is not "listed" as rare or endangered.

Respons 10

Section 2.8.3 has been modified to express this concern.

Comment 11

Oyster beds should be discussed in revised Section 2.8.7, Special Habitats.

Response 11

Oyster beds are discussed in Section 2.8.6.

Comment 12

The possible impact of the log export facilities on nursery and breeding grounds for fish and shellfish should be expressed in Section 4.8.7.

Response 12

These impacts have been discussed in Section 4.8.9 and Appendix L.

Comment 13

Table 17 should be corrected to include indications of commercial fisheries.

Response 13

Table 17 now compares alternative sites with respect to commercial salmon gill net fisheries.

Comment 14

Appendix F, Flora and Fauna, should list marine invertebrates.

Response 14

A list of marine invertebrates found in baseline studies is available in Thut et al. (1978), Fresh et al. (1979), and Wisseman et al. (1978) on which this EIS is based.

P. NOISE AND HUMAN ACTIVITY

Comment Letters: 14,16,18,32,34,51,52,53,59,61,66,76,80,89

Comment 1

The discussion of noise and human activity impacts on wildlife on the site, in the refuge, and on Anderson Island is inadequate. The DEIS does not provide noise contours for existing noise levels, which makes it impossible to determine where significant changes in noise levels would occur. The levels of additional noise over existing levels should be shown. The study should recognize the special characteristics of sound traveling over water.

Response 1

A supplemental noise study has been performed that more thoroughly addresses the special considerations of noise impacts on Anderson Island, Nisqually Reach, and the Nisqually Delta. Table G-5, Appendix G, describes predicted changes in noise levels at these sensitive receptors. Section 4.9 has been modified to include impacts identified in this study. Also, refer to Appendix G, Noise Effects on Wildlife, for a review of impacts affecting wildlife.

Comment 2

The DEIS is inconsistent in assessing noise, human activity, and ship movements impacts on wildlife. Pages 132, 133, and 138 assume little impact on wildlife, birds, and waterbirds, while page 168 states that increased noise might adversely affect waterfowl and other animals in the refuge.

Response 2

The FEIS has been modified to reflect these concerns. Refer to revised Sections 4.6.3 and 4.6.4. Noise levels in the wildlife refuge would increase significantly especially when the wind is from the north during dock operations. Sensitivities of the species inhabiting the refuge to elevated noise levels are unknown. It is probable that some disturbances might occur to some species.

Comment 3

A study by Calambokidis showed that 50 to 81 percent of disturbances to harbor seals were caused by humans.

Response 3

Acknowledged. According to Calambokidis et al. (1978), these human-caused disturbances "came primarily from approach to the haul out area by boat or vehicles, and from duck hunting near the haul out area." It is unlikely that harbor seal use of haulout areas on the Delta mudflats would be disturbed by activities at the DuPont site. Refer to Section 4.6.6, as modified, for further discussion related to harbor seals.

Comment 4

Noise impacts to uplands and adjacent waters should also be mentioned.

Response 4

Revised Section 4.9 discusses noise impacts on upland and adjacent waters.

Comment 5

The FEIS should note that as species affected by noise attempt to relocate, increased competition for food and territory would reduce populations and species diversity.

Response 5

The success of displaced animals in surrounding habitats would depend on the numbers of individuals present. Such habitats very likely already support wildlife at carrying capacity. In critical periods such as winter, sublethal stress due to increased competition for life requisites, such as food, could result in reduced natality and increased mortality in these populations. Whether or not accompanying decreases in species diversity would result from such displacement would depend on the availability of suitable habitat in the new habitat. If no suitable habitat is available then species diversity in the local area may decrease.

Comment 6

The moderate to severe impacts section should include the impact on wildlife from increased noise and human activity regardless of whether federal standards would be exceeded.

Response 6

The summary has been revised to show impacts without assessing the degree of significance of the impact. These impacts are addressed in Sections 4.6.3, 4.6.4, and 4.9.

Comment 7

Changes in noise levels of 10dBA or more should be evaluated for mitigation.

Response 7

Mitigating measures for noise impacts are discussed in Section 4.9 of the FEIS.

Comment 8

Wildlife should be considered noise sensitive receptors.

Response 8

The Department of Ecology does consider the Nisqually Wildlife Refuge to be a sensitive noise receptor (Class A EDNA). Refer to Sections 2.9 and 4.9 of the FEIS.

Comment 9

What about the noise of additional foghorns for navigation?

Response 9

Additional foghorns would result from increased ship traffic. However, due to the infrequent required use of foghorns on the southern Sound, the impacts are expected to be minimal.

Comment 10

What effect would increased train coupling and truck traffic have on the Delta and on eagle overflights?

Response 10

No significant impacts on the Delta or on the bald eagle due to increased train and truck noise are expected. Eagle overflights are presently infrequent and are expected to remain so.

Q. ENERGY

Comment Letters: 14,34,49,58

Comment 1

The EIS should discuss more fully the energy consumption of the proposed facility, including projections for a totally developed site. Comparisons of present energy use on the site with other Weyerhaeuser facilities and the alternative sites should be developed. To what extent the facility would use fossil fuel, what energy sources Weyerhaeuser would use to replace fossil fuels in the event present supplies become unavailable, how it would convert to alternative energy sources, and the consequence of this change should be made clear.

a. What alternative forms of energy could Weyerhaeuser bring on-line within two years?)

b. If not within two years, what would be the necessary lead time to bring alternative systems on-line?

c. What would be the economic ramifications of bringing alternative systems on line?

d. Once on line, what would be the environmental impacts of these alternative systems. Would another EIS be necessary?

e. Would the project have an effect on the cost and availability of electricity to other customers served by Puget Sound Power and Light? Do power contracts have an interruptibility clause to assure priority of supplies to households?

f. How would federal fuel allotments for Pierce County be affected by this project and by future industrial development at the site?

Response 1

See Section 4.16.2 of the FEIS, which has been expanded to include discussion of concerns a, c, d, and f. Responses to comments b and e follow. (b) Alternative forms of energy would be periodically analyzed and would most likely be put on-line at the time that they were identified as cost-effective alternatives to the existing energy sources. (e) Industrial and residential users of electrical energy are charged on different rate schedules. Power to residential homes would not be interrupted in favor of industrial users.

R. OIL SPILLS - RISKS AND IMPACTS

Comment Letters: 6,7,16,18,32,34,56,61,76,77,78,79,80,82

Comment 1

The DEIS is inadequate in its assessment of the risks and impacts of potential oil spills. More thorough discussion is needed on the impacts of spills on recreation; the intertidal habitat, Delta, mudflats, saltmarshes, and Nisqually River; and on wildlife, including especially amphibians and reptiles, harbor seals, whales and porpoises, fish and shellfish, birds, and mammals.

Response 1

Section 4.8.9 includes an expanded discussion of such impacts. Refer also to Appendix L.

Comment 2

An economic analysis of these impacts should be part of the assessment, including the number of jobs lost due to oil spills.

Response 2

According to the oil spill risk analysis (Appendix L), the proposed project may result in one significant spill (greater than 2.4 barrels) every 103 to 325 years, depending on the number of port calls. Due to the unlikelihood of such an occurrence, an economic analysis was deemed unnecessary.

Comment 3

The impact assessment should include consideration of the cumulative long-term effects of lowered water quality, reduced diversity of inhabitants, and buildup of hydrocarbons.

Response 3

Section 4.5.4 discusses expected long-term cumulative impacts on water quality. Section 4.8.7 discusses such impacts on marine resources and Section 4.8.10 discusses long-term impacts of an oil spill on ecological relationships of Nisqually Reach communities.

Comment 4

The risks and impacts of smaller spills has not been addressed, including the cumulative effects of small spills and chronic low-level pollution from dockside support activities. Rates of occurence for small spills (spills under 25, 50, and 100 gallons are suggested) and for inadvertent or illegal discharge of oily ballast should be calculated. This calculation should

include spills of unknown as well as known causes (see 1976 WDE report, Water Pollution Incidents Reported in Washington State during 1974, which states that six out of 10 incidents are attributable to unknown causes) and reported as well as unreported incidents.

Response 4

No oil products would be loaded at the dock. Dock runoff and any fuel spills from loading equipment would be captured in a large tank underneath the dock where oil would be separated from the runoff. Treated runoff from the dock and dock access road would contain approximately 10 ppm hydrocarbon. Dilution and dispersion would result in no significant effects on water quality. Thus, chronic, low level oil discharges would be infrequent due to routine dock activity. Also, refer to Section 4.11 which describes risks of small spills and Section 4.8.7 for a discussion of chronic impacts on Nisqually Reach communities.

Comment 5

The risk assessment is inadequate in that it is based on assumptions that are subject to change in the future. The DEIS contains no assurances that the assumptions of vessel design, frequency of call, dockside design and activity, and trade routes would not change. The risk assessment also is based on a stated frequency of ship calls per month but does not consider the possibility of other shipping increases in the south Sound in the future.

Response 5

It is realized that the risk assessment is based on assumptions relative to present conditions that may or may not change in the future. It is appropriate to base assumptions on present day conditions. Basing assumptions on potential future conditions or changes would be highly speculative and would not likely represent potential worst case conditions as it is likely that any future changes in vessel design, etc, would tend to be made in light of lowering the potential for risk of oil spills rather than increasing the risk.

The Weyerhaeuser oil risk analysis focuses on the potential impact of increased Weyerhaeuser activity in southern Puget Sound and the associated risk of oil spillage due to that activity.

In the future, if another entity proposes to increase shipping activity in the southern Puget Sound, it would become the responsibility of that entity to analyze the potential for increased risk of oil spillage due to the respective proposed activity in light of existing/predictable shipping activities at that time.

Comment 6

Modeling to assess the direction and impacts of a spill is deficient. The marine hydrology studies gathered insufficient data on current behavior over the Nisqually Flats by making only limited spot checks, thus limiting the profile of current behavior throughout the daily and annual tidal cycles. The computer model was unable to replicate either the shallow tideflats or the freshwater/saltwater interface of the estuary, which resulted in subjective rather than systematic analysis. Based on these data and model limitations, the model was unable to predict current directions or velocities and thus potential movement of an oil slick.

Response 6

It is true that the hydrologic model is unable to predict the direction and velocity of the current in the shallow tideflats. But, this deficiency does not affect the outcome of the oil spill analysis. Because the model assumes that the shoreline in the Nisqually flats is the front edge of the tide flats (any place less than 40' deep), when the trajectory of an oil slick reaches the edge of the flats, it is considered a "hit". Thus, the probability and risk analyses do not specifically address oil movement onto the tideflats.

Comment 7

Drogue studies did not substantiate the model's prediction (Figure 3-11 of the Hydrological and Modeling Studies) but showed that spills would more likely end up in the estuary rather than on the shoreline south of the wharf as predicted by the model.

Response 7

The model was predicting the current vector for a 3 June 1977 event. No drogue study was conducted for the same event. Comparisons are inappropriate.

Comment 8

The probability of conditions favoring transport of contaminants in Table L-1 of the DEIS is also underestimated by leaving out calm weather conditions and the frequency and impact of easterly winds.

Response 8

The intent of Table L-1 (Summary of Wind Direction and Velocity Probabilities) in the DEIS was only to illustrate the higher probability of winds from the south in summer and winter than from the north.

Comment 9

The effectiveness of the Nisqually River freshwater plume to protect or reduce overall impacts of oil on the estuary is unsubstantiated by quantitative data.

AD-A116 180 URS CO SEATTLE WA F/G 13/2
WEYERHAEUSER EXPORT FACILITY AT DUPONT. VOLUME I.(U)
MAY 82

UNCLASSIFIED NL

5 5

END
DATE
FILMED
8 82
DTIC

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Response 9

It is acknowledged that no quantitative modeling has been conducted to assess the effectiveness of the Nisqually River freshwater lens in protection the Delta from an oil spill. The intention of this discussion in Appendix L was only to recognize that under some conditions (e.g., non-northerly winds and high river flows) the freshwater lens and debris line may offer some resistance to floating oil, thereby affording some unknown level of protection to the Delta.

Comment 10

Detailed contingency plans and enforcement plans should be developed before the permit is granted. These plans should cover both large and small spills. A comparison of the effectiveness of these plans with those of other ports should be made. These plans should be reviewed by all appropriate agencies before they are adopted. Methods to clean up oil should be thoroughly examined for impacts. For example, use of detergents may prove harmful to marine organisms and birds.

Response 10

Before construction begins, Weyerhaeuser must submit a written oil spill contingency plan describing plans for prevention, containment, and control of spills of oil and other contaminants during construction for review by the Coast Guard and EPA. Before operations begin, an operational phase spill contingency plan would be submitted to these reviewing agencies. All appropriate information as described in Appendix M will be included in these plans.

It is assumed that the adequacy of Weyerhaeuser's plan would be considered by the Coast Guard and EPA based in part on their experience with plans developed for other ports.

Comment 11

The EIS should discuss the smothering effect of heavy-weight tar-like oil on subtidal fauna.

Response 11

These effects are described in Appendix L.

Comment 12

Contrary to the statements made on page L-8, oil spills are especially difficult to clean up, particularly in salt marsh and mudflat habitats. See the State Department of Ecology report on the North Puget Sound Baseline Program.

Response 12

Acknowledged. Appendix L has been modified to reflect this comment.

Comment 13

The amount and place of fueling needs better study to ensure that only a small amount of fuel would be in any vessels entering the south Sound.

Response 13

The Weyerhaeuser Company does not plan to schedule fueling stops to ensure that only a small amount of fuel would be in any vessel entering southern Puget Sound. According to Weyerhaeuser, such practices are not common to other shipping entities in the southern Puget Sound. Such a study is considered outside the scope of this EIS.

Comment 14

All references to oil spills should use the wording "until" an oil spill occurs, rather than "when" or "if".

Response 14

Since a significant oil spill due to a ship accident has been shown to have a low probability of occurring in any given year (Section 4.11), the conditional "if" is appropriate when discussing the possible results of such an event.

Comment 15

The discussion of estuary recovery after an oil spill is contradictory and should be clarified.

Response 15

References to estuarine recovery from an oil spill have been clarified. Refer to Section 4.8.10 and Appendix L.

Comment 16

The analysis of oil impacts on life forms and habitats in Appendix L should include references to Engelhardt (1978), Geraci & Smith (1976), Blumer (1970, 1971), and EPA (1973).

Response 16

The papers by Engelhardt (1978), and Geraci and Smith (1976), have been reviewed and incorporated as appropriate into discussions in Appendix L. A more recent review, authored by Dr. M. Blumer (1973), was reviewed and cited in the reference list in Appendix L. The EPA (1973), reference was not reviewed. Over 50 papers were reviewed in the preparation of Appendix L. The literature on oil spills and effects of oil on organisms and communities is vast. It was not possible to review all potential sources of information in the preparation of this EIS.

Comment 17

Larger than 400 gallon figures and foggy conditions should have been used in the oil spill risk analysis.

Response 17

The risk analysis presented in Section 4.11 of the FEIS shows the risk of spills of different magnitudes that would result from Weyerhaeuser traffic: 2.4 to 10 barrels, 10.1 to 50 barrels, and greater than 50 barrels. The 400 gallon figure in the comment is equivalent to approximately 10 barrels of oil. Thus, the risk of a spill this size falls in the range 10.1 to 50 barrels.

Navigational and oil spill risk analyses use historical information to assess the risk of casualties caused by known increases in traffic levels. These risk analyses do not attempt to predict casualties under various meteorological conditions, such as foggy conditions.

Comment 18

The inconsistency about when the contingency plans would be prepared should be clarified. Page L-8 states they would be prepared after design but before construction, while Appendix M states after construction.

Response 18

See response 10 in this section.

Comment 19

Even small oil spills could result in serious long-term adverse impacts.

Response 19

Section 4.8.10 and Appendix L indicate that studies have shown that recovery of flora and fauna following an oil spill can take from one to several years. The seriousness of the impact would be largely proportional to the size of the area impacted, the volume of oil spilled, the constituency of the oil, and other factors such as weather and cleanup procedures.

Comment 20

Spill rates are based on those of smaller port systems in Maine, California, Florida, etc. It should be clarified whether these ports have navigational characteristics and vessel traffic similar to southern Puget Sound.

Response 20

The only selection criterion for inclusion of ports in the risk analysis was size (i.e., traffic levels). Small ports were used in the analysis and were compared with the small port area of Nisqually Reach. This was the most reliable method because historic traffic levels in this area are very low. The comparison of the data from small ports to southern Puget Sound were statistically significant at the 95 percent confidence interval.

Comment 21

It should be mentioned (page L-13) that if a spill affects the food resources of fish, then the fish would be affected as well.

Response 21

This statement in Appendix L concerning biological impacts due to an oil spill has been modified to include such potential impacts. Sections 4.8.9 and 4.8.10 also discuss such impacts.

Comment 22

Modeling should have been done with Toliva Shoal or the Narrows as a point of escapement.

Response 22

The modeling assumptions used in the oils spill risk analysis were selected because Weyerhaeuser ships would spend the greatest amount of time (3 days) in the vicinity of the proposed export facility as compared to the very limited time spent passing by or through Toliva Shoal and the Narrows.

Comment 23

Under moderate to severe impacts the potential for bunker oil spill should be added.

Response 23

The summary has been modified to reflect this concern.

Comment 24

The EIS should indicate that a spill could occur as early as the date of the first ship call.

Response 24

This possibility is inherent in any discussion of the probability of an event occuring. The text has been changed in Section 4.11 to reflect this comment.

S. NAVIGATION RISKS AND IMPACTS

Comment Letters: 1,6,7,16,18,32,34,51,52,53,59,61,66,76,77,80,89,91,92,

Comment 1

The risk assessment apparently does not account for increases in other commercial and recreational vessel traffic in the south Sound. The figures the assessment was based on end in 1975. What are current and projected figures and what types of vessels are included? The risk assessment should be based on 53 port calls per year rather than on 28 port calls. What change in risks can be expected when Weyerhaeuser makes its final selection of vessels, dock design, and port calls.

Response 1

The risk assessment has been updated (OIW, 1980) to include a wide range of port call scenarios ranging from 88 to 28 calls per year. These corresponding changes in risk are identified in OIW, 1980 and Section 4.11 of the FEIS. This risk analysis assesses the impact of increased Weyerhaeuser ship traffic. The statistical model employed in OIW, 1980 accounts for growth in commercial and recreational traffic in the south Sound by correlating the number of oil spill incidences to the number of port calls in several similar sized ports throughout the world. The correlation coefficients of the model are statistically very high indicating the appropriateness of applying the model to the proposed export facility.

Comment 2

What change in risks can be expected in light of plans to greatly increase the salmon fisheries in the area?

Response 2

See Section 4.8.8 of the FEIS for a new discussion of fisheries impacts.

Comment 3

What improvements to navigation practices would be needed if the large ships Weyerhaeuser intends to use call at DuPont? What special problems and procedures for navigation in the Tacoma Narrows and southern Puget Sound can be expected as a result of fog, wind shear, strong tides, extreme weather and water conditions, and wakes from ships? Ports comparable to DuPont should be compared for extreme weather, grounding, tides, and currents.

Response 3

According to the Puget Sound Pilots, the navigational hazards for ships calling at DuPont would not be exceptional. Navigational procedures would not vary appreciably in fog and winds, except that severe conditions may delay docking. See Section 4.11 of the FEIS. Newer generations of ships would reflect improvements in navigational equipment and capability.

Comment 4

What effect would the 60-foot draft requirement have on European and Far Eastern ports? Are facilities available or would dredging be required.

Response 4

It is assumed that foreign ports would be capable of handling deep draft ships by the time such ships are designed and built.

Comment 5

The risk assessment included only two classes of ships (Dupont and M), but the Hoegh ships now in Weyco's fleet should be included.

Response 5

The risk assessment is based on historical spill rate data for statistically comparable ports to that proposed for DuPont. The high correlation coefficients between number of oil spill incidences per number of port calls at the various ports employed in the model lend statistical credence to the applicability of the model to the proposed DuPont facility. Fleet mixes included in this data are considered to be statistically comparable to the mix of ships that will be used at DuPont. The six "M" ships are Hoegh ships and the remaining two differ from them only superficially.

Comment 6

Would ballast be needed for ships to maneuver through the Narrows? Where would they load and unload the ballast.

Response 6

See Section 4.5.4 of the FEIS. Some ballasting would be required while ships are loading to maintain proper trim. In complying with federal regulations that are enforced by the U.S. Coast Guard, only clean sea water would be discharged.

Comment 7

The proposed site should be described as exposed and unprotected for docking.

Response 7

Section 1.3 has been modified to reflect this concern.

Comment 8

Limits should be established for the number and size of ships.

Response 8

Weyerhaeuser Company has projected the number and size of ships to be used at the proposed facility, (OIW, 1980), but has not made a commitment to this projection. The number and size of ships to be used is highly dependent on the market for wood products making it difficult to commit to any specific projections, although such projections are based on the best available data.

Comment 9

The DEIS fails to show major examples of ship design that were derived to ameliorate impacts, contrary to the purpose stated in L-1. Safety features such as double skin side walls, twin screws, and bow/stern or side thrusters are absent from the DuPont class ships and the M class features only the double walls.

Response 9

The OIW (1977), in the environmental baseline study "DuPont Navigational Risk Assessment," concluded that the probability (risk) of a casualty was very low. The study also assessed the design features of M ships and DuPont class ships. The study stated:

> The main hazard mitigation measures for vessel design are navigational equipment, maneuverability, fuel oil handling, and structural failure avoidance.
>
> Navigational Equipment - This complement of navigation equipment meets or exceeds current modern marine practice for ships of the sizes presently under construction.
>
> Maneuverability - The maneuvering characteristics of the vessels (M ships) are better than the average for vessels of equivalent size.
>
> The "DuPont" class ships are expected to have a larger turning circle diameter and a longer stopping distance due to the size increase. Nevertheless, the maneuvering characteristics of the larger vessels should be comparable to the M class characteristics and should be adequate to permit safe navigation to and from the DuPont Export Facility.
>
> Structural Failure Avoidance - The M class vessels and the DuPont class ships have (or will have) a Kockums Loadmaster computer aboard which enables shipboard personnel to calculate the load and stresses on the ship in each stage of loading. The computer is programmed to provide warnings of potentially dangerous loadings and should reduce the possibility of a structural failure due to an improper loading sequence.

T. TRAFFIC AND TRANSPORTATION

Comment Letters: 13,16,18,19,20,34,67

Comment 1

Consideration should be given to an alternative dock access network, preferably one avoiding the Sequalitchew Creek corridor, to avoid direct and indirect impacts on wildlife and habitat. A potential alternative that should be covered in the FEIS would be to locate the dock at Tatsolo Point, near the existing sewage treatment plant. This alternative would allow an access route almost due north with an easement through federal land.

Response 1

This alternative has been discussed in Section 6.7.3.2 of Chapter 6, Alternatives, and in Appendix Q, response C-15.

Comment 2

The safety of the Mounts Road interchange from increased traffic, particularly for local residents who use it for their own private and commercial needs is of concern.

Response 3

The Mounts Road interchange would be designed according to projected traffic increases such that the design capacity would allow for safe use of the road.

Comment 3

Would Weyerhaeuser build an overpass to eliminate train-traffic tie-ups?

Response 3

Weyerhaeuser does not have any plans to build an overpass to eliminate train-traffic tie-ups.

Comment 4

What is the relationship of the state toll station to the interchanges? Would Weyerhaeuser trucks pay highway fees? How?

Response 4

Weyerhaeuser trucks would pay all applicable state highway fees as required by law.

Comment 5

Who pays the upkeep on a state-dedicated roadway?

Response 5

At the present time, no project roadways would be state-dedicated roadways. The access road from Interstate 5 to the upland terminal would be maintained by Weyerhaeuser.

Comment 6

The Hannah Pierce Freeway should be mentioned in Section 2.14.1 and under severe to moderate impacts.

Response 6

There is currently no proposal for Hannah-Pierce Freeway according to the Pierce County Engineering Department.

Comment 7

Impacts on Sequalitchew Creek and Canyon should include noise, vibration, blocked access, and air pollution from trucks.

Response 7

These impacts are discussed in Chapter 4 of the FEIS.

Comment 8

The proposed off ramp that Y-s off the existing ramp is not operationally feasible. The sketch on page 11 and ramp plan should be approved by the State Department of Transportation before publication of the FEIS.

Response 8

Weyerhaeuser's design of the off ramp would be reviewed by the Washington State Department of Transportation (DOT). Approval of the final design by DOT would be required prior to construction.

U. ECONOMIC IMPACTS

Comment Letters: 1,25,29,30,32,34,39,56,58,85,89

Comment 1

The economic influence of the project must be more carefully weighed against its environmental impacts. The discussion should offer a more comprehensive cost/benefit analysis that would consider direct and indirect impacts both locally and on the entire region. This analysis should include the forest products industry, forest resources, and the labor market. It should also include analysis of future development of the site, the shift to the site of other industrial activity, and alternative development possibilities.

Response 1

The potential socioeconomic impacts resulting from the proposed export facility were analyzed in detail in the "DuPont Export Facility Socioeconomic Impact Study", URS Company, 1978 and summarized in Sections 4.12, 4.13, 4.15, and 4.17 of the FEIS. Because of the minor potential for significant adverse environmental impacts resulting from the project (Chapter 4), additional economic study on potential environmental impacts does not appear to be necessary. The City of DuPont will be preparing a Comprehensive Land-Use Plan in the near future. Analysis of potential future development at the site will only be possible following the finalization of the land-use plan as future development at the site now is uncertain. Potential economic impacts from future development will be presented in the land-use plan.

Comment 2

The economic impact on commercial and recreational activities in south Puget Sound, including tourism, recreational boating, sports and commercial fishing, aquaculture, and shellfish resources should be discussed more fully. Dollar figures for the economic value of these activities and potential economic base for the productivity of these waters should be developed.

Response 2

The potential environmental impacts resulting from the proposed facility, including impacts to tourism, recreational boating, sport and commercial fishing, and the associated risk of impact (Chapter 4, FEIS) are not significant enough to warrant further economic studies. Also refer to response 1 directly above.

Comment 3

What is the relationship of the present low tax rate to the known low density of development?

Response 3

The assessed value of the City of DuPont has steadily increased due to city annexations and land improvements since 1971.

The demand for public services during this time has not increased as rapidly as the city's assessed valuation. This has allowed the city to lower the tax rate while still experiencing an increase in tax dollars sufficient enough to cover public costs. Also refer to Section 2.8.3 of the FEIS.

Comment 4

The assumption of an adequate labor pool for construction and operation in light of projects at the Navy's Trident Submarine Base and the Satsop nuclear plant should be re-examined.

Response 4

The Washington State Employment Security Department statistics show that in May 1980, over 2400 construction workers filed for unemployment benefits in Thurston and Pierce Counties. This unemployed labor force is adequate to supply the 325 workers for the proposed facility construction. In addition, the labor force at Satsop has been dramatically reduced, since the comment letters were written, due to the slowing down of construction on the Washington Public Power Supply System Nuclear Unit 4.

Comment 5

What impacts on jobs at Tacoma, Everett, and Longview would the project have?

Response 5

The proposal would cause some direct reduction and redistribution in the region's existing work force. Efficiencies brought about by the use of larger ships when export volumes approach design volumes (1985-90) would reduce the company's longshoreman requirements by 36 to 45 jobs (Tacoma, 18 to 23 jobs; Everett 3 jobs; and Longview, outside the southeastern Puget Sound region, 15 to 19 jobs). Approximately 38 transportation employees from the company's Tacoma facility may be transferred to the DuPont location. Consequently, Tacoma's employment would be reduced by as many as 61 workers. These reductions would be small compared to existing employment in the region. At the same time, manufacturing employment would increase in Weyerhaeuser's western Washington operations, producing a net increase in employment over a larger region.

Comment 6

What would be the economic impacts of the facility on Thurston County?

Response 6

As described in the *"DuPont Export Facility Socio-economic Impact Study"* (URS, 1978), marginal increases in employment, housing, and population activities and their indirect effect on public services would be generally dispersed throughout Pierce and Thurston counties. Therefore, relative to existing activity levels and the current capacities of public services in these jurisdictions, the fiscal effects of the export facility would be small.

V. AESTHETICS

Comment Letters: 16,34,76,89

Comment 1

The discussion of aesthetics does not clearly present the adverse impacts of removing trees, visibility of the dock access road, imposition of the dock, and view of cranes and ships. Lowered aesthetic and recreational values for residents and visitors should be mentioned as adverse impacts.

Response 1

The FEIS states that the proposed development would adversely impact the existing shoreline viewshed. As stated in Section 4.19, upland development would be screened from view by existing vegetation from Nisqually Reach, the Delta, Anderson Island, and the Village of DuPont; only a small portion of the site would be visible from DuPont-Steilacoom Road and north Fort Lewis. Landscaping with berms and vegetation would reduce visual impacts of the access corridor to the site (Section 4.19). The most significant visual changes would be those of the dock, visible from Anderson Island and Nisqually Reach, portions of the Nisqually Delta, Interstate 5, and the areas west of the Delta.

Comment 2

The EIS should mention that Interstate 5 provides a pleasing view of the Delta to passing motorists.

Response 2

The FEIS has been modified accordingly. See Section 2.19.

Comment 3

Visibility of the dock should be clarified. Who would see it and from what locations?

Response 3

The dock would be visible from Nisqually Reach, portions of the Nisqually Delta, an area west of the Nisqually Delta, and Anderson Island.

Comment 4

The discussion of aesthetics should include noise and odor.

Response 4

Noise and odor are discussed in Sections 4.9 and 4.4, respectively.

W. HISTORICAL AND CULTURAL

Comment Letters: 6,16,23,32,34,63,76

Comment 1

There is no commitment for carrying out testing and other procedures required by 36 CFR Part 800 in advance of ground-disturbing activities. Because numerous burial sites of Indians, missionaries, and settlers are not marked, there must be firm guarantees that archaeological experts are called in immediately to examine evidence uncovered during heavy construction. Allowance in the schedule should be made to encourage construction crews to notify experts. Was the extra time during which construction work is halted included in construction schedules? The EIS should include this commitment and correspondence from the state historic preservation officer reflecting consultation required by 36 CFR Part 800.

Response 1

Consultations with the State Historic Preservation Officer (SHPO) have occurred. All appropriate measures to protect historical resources will be taken. As described in Section 4.20.1, testing in certain sensitive areas is planned. If the current determination that the project would not affect significant cultural resources proved to be incorrect, additional steps, appropriate to the situation, would be taken in consultation with the SHPO. As stated in Section 4.20.1, all contracts for construction work that could disturb any known or unknown archaeological artifacts would contain clauses requiring the contractor to participate in briefing and training sessions with the SHPO, and to immediately stop work and notify the SHPO if any archaeological artifacts are discovered, and to suspend all work in the area of such artifacts until completion of consultation with the SHPO. A letter in Appendix H dated 15 July 1981 reflects the required consultation with the SHPO conducted during development of the EIS.

No specific construction schedule is presently available. As stated above, contractors will be aware of the requirements described above, and so will include such contingencies in work schedules.

Comment 2

In spite of procedures such as fencing and patrolling, an increase in pot hunters seems unavoidable and should be included as an unavoidable adverse impact.

Response 2

According to Weyerhaeuser officials, illegal digging presently occurs on the site. Whether or not it would increase due to the project is speculative.

Comment 3

The EIS should note that the Nisqually Delta has been placed in a Threatened Category II status (PL 94-485) by the Heritage Conservation and Recreation Service of the Department of Interior because of imminent industrial development on both sides of the Delta and associated future development.

Response 3

The FEIS notes this characterization, see Section 3.1.4.5.

Comment 4

Why isn't there a map of the historically significant sites?

Response 4

See Section 2.20 of the FEIS.

> "Information on location of archaeological sites is exempt from disclosure under state and federal law (RCW 27.53.0020-.090 and PL 94-458)."

The purpose of this exemption is to avoid unauthorized disruption of archaeological resources.

Comment 5

More should be said about preservation and reconstruction of the Fort Nisqually site.

Response 5

It is not clear from the comment which Fort Nisqually site is being referred to. The project, as presently designed, would avoid both the 1843 Fort Nisqually site as well as the 1833 Fort Nisqually site.

X. OPERATIONS

Comment Letters: 18,34

Comment 1

The use of gardens and lawns would require increased fertilizer and water use. Why not restrict landscaping to native plant gardens?

Response 1

Detailed landscaping plans are not yet available. Native plant gardens will be used where possible.

Comments 2

If potable water cannot be supplied from existing wells, where would it come from?

Response 2

Bottled water would be provided for drinking as is presently the case.

Comment 3

A detailed list of materials and chemicals to be handled at the facility should be in the EIS. Would distillates or extractives be exported?

Response 3

According to Weyerhaeuser, the proposed Export Center was purposely designed to provide the ability and flexibility to handle effectively the full array of all forest products with the primary emphasis on finished products. The product mix shipped through the Export Center cannot be specified at this time and would be dependent on product market opportunities; however, Weyerhaeuser does not now export chemicals, distillates or extractives from its northwest facilities and has no current plans to do so.

Comment 4

Estimates for amount of bark to be produced by debarking operations should be included in the EIS. How much would be stockpiled for sale or shipment to other Weyerhaeuser facilities? Would barks be stored under cover?

Response 4

Bark would be stored in enclosed containers; therefore, no runoff or leachate would be generated. Quantities and storage times would depend upon operational factors that cannot be specified at this time.

Y. FIGURES

Comment Letters: 11,16,17,34,56,76

Comment 1

The maps on pages 107 and 108 indicate City of DuPont jurisdiction overlaps a considerable portion of the Nisqually Refuge. Perhaps some explanation of the nature of this jurisdiction is needed. Also, it should be pointed out that the city's adopted shoreline master program does not cover this area of its jurisdiction. This area presently is included in the Pierce County Shoreline Master Program. To the extent these programs and the Coastal Zone Management program pertain to federal lands, clarification is needed here.

Response 1

The City of DuPont's incorporation boundary extends to the middle of Nisqually Reach for the full length of the Weyerhaeuser ownerhsip and includes the northerly portion of the tidelands within the refuge. Pierce County's Shoreline Master Plan governs only the remaining portion of the Delta. The figures have been modified to reflect this concern.

Comment 2

In addition, the map on page 107 of the DEIS indicates Weyerhaeuser ownership in the dock vicinity extends well out over bedlands that are actually state owned. The EIS should clarify Weyerhaeuser tideland ownership within the Nisqually Reach or Delta.

Response 2

Refer to revised Section 3.1. Weyerhaeuser does not own tidelands in the Nisqually Wildlife Refuge. They do, however, own tidelands (from ordinary high tide to extreme low tide) north of the Refuge. The state owns the bedlands below the tidelands.

Comment 3

The approximate location of the upland septic drainfield should be shown in Figure 9.

Response 3

The location of the upland septic drainfield has not been determined yet, but it would be no closer than 500 feet from Sequalitchew Creek and the bluff adjacent to Puget Sound.

Comment 4

Figures 2 and 54 of the DEIS are misleading since they indicate that the Nisqually Delta lies considerably south of the jetty, whereas it actually extends north of the jetty and is about 1/2 mile from the DuPont pier. Perhaps the figure could show 1.6 miles to the salt marsh instead of Nisqually Delta.

Response 4

Figures 2 and 51 of the FEIS have been modified to show 1.43 miles from the south end of the proposed dock to the Nisqually Delta salt marsh.

Comment 5

Figure 47 of the DEIS incorrectly identifies FWS ownership.

Response 5

Figure 44 has been amended to correctly identify FWS ownership.

Comment 6

The legend of Figure 15 of the DEIS should mention that contour lines are in feet.

Response 6

This change has been made in Figure 15.

Comment 7

The shoreline of statewide significance should be shown on one of the maps in the land use section.

Response 7

This designation has been added to Figure 48 in the FEIS.

Comment 8

Tolmie and Eagle Island State Parks were not identified on Figure 39 of the DEIS.

Response 8

Figure 39, identifying parks and recreational sites in the DEIS, has been omitted from the FEIS.

Z. MISCELLANEOUS

Comment Letters: 11,16,23,24,28,34,38,40,54,76,92

Comment 1

In Table C-3 of the DEIS the standards for photochemical oxidants for the Puget Sound region should be changed from "same as national" to 160 mg/m^3. Also "sulfur oxides" should read "sulfur dioxide."

Response 1

These corrections have been made.

Comment 2

The glossary definition of "abundant" as greater than 100 conflicts with the DEIS text definition (page 66, paragraph 1) as greater than 200.

The glossary definition of "common" as 2-100 organisms conflicts with the DEIS text (page 66, paragraph 1) as 2-200.

Response 2

The glossary has been modified to be consistent with the text usage.

Comment 3

A footnote in Table G-4 refers to Figure 2-23 which does not appear in the document.

Response 3

The reference should have been to Figure 33. This has been corrected.

Comment 4

The definitions of intertidal and subtidal should be clarified (page 66, paragraph 1, DEIS). A salt marsh at 13 feet above MLLW is inundated, and, therefore, intertidal. Subtidal extends as deep as the water.

Response 4

See the definitions in the glossary. The definitions in the text referred to the limits used in the cited studies.

Comment 5

Regarding the statement "virtually all intertidal life is represented in plankton...", some species of clams, brittlestar, and periwinkles are exceptions. The wording should be changed to "most."

Response 5

Section 4.8.2 of the FEIS has been modified to reflect this comment.

Comment 6

Add a statement that NEPA requires evaluation of all significant environmental impacts stemming from the project, including those shoreward of mean highwater, and that such evaluations should be a factor in the decision-making process.

Response 6

Acknowledged. The FEIS evaluates all potentially significant environmental impacts as required by NEPA. These evaluations will be the major factor in the permit decision process.

Comment 7

In the description of the location, add that Weyerhaeuser property is bounded on the west by Burlington Northern tracks, and that beyond the tracks, the city is bounded on the west side by the refuge.

Response 7

This statement has been added to Section 1.2 of the FEIS.

Comment 8

There should be a heading "Reptiles and Amphibians" in Table F-6, Appendix F.

Response 8

This heading has been added in Table F-6.

Comment 9

Table 13 should be retitled to reflect the nature of the listings, since several historic sites are listed under the prehistoric category.

Response 9

It is true that the names given to several of these sites refer to historic features. These historic features, such as the crystallizer, which was associated with the DuPont Company's operations, are located at sites also known to be important prehistoric sites. These are the names used by Onat et al., 1977.

Comment 10

Table 14 of the DEIS should be retitled to reflect structures as well as sites. The reference of item 4--DuPont Company--in this table should be clarified.

Response 10

Table 16 of the FEIS lists archaeological and historical sites in the DuPont area recorded in the baseline survey by Onat et al. (1978). Use of the term "site" is consistent with the terminology used in the baseline report.

Item 17--DuPont Company--refers to the existing buildings and remnants of buildings that made up the DuPont Company's manufacturing facilities.

Comment 11

Reorganization of the baseline studies column should be made in the list of preparers.

Response 11

Appropriate modifications have been made in the FEIS to the list of preparers.

Comment 12

The summary should state that the shoreline's aesthetic value will be lowered rather than "altered."

Response 12

The summary has been modified to reflect this concern.

Comment 13

Regarding the statement on page xiii of the DEIS that Weyerhaeuser has publicly pledged to do nothing that would harm the Delta, we have no idea what the company would do if damage does occur, so the pledge is meaningless.

Response 13

The proposed USFWS-Weyerhaeuser Memorandum of Understanding described in Sections 1.6 and 3.3 reflects legal commitments undertaken by Weyerhaeuser to protect sensitive areas on and near the site. In addition, project design and monitoring is intended to reduce risks to the Delta.

Comment 14

Regarding page XV of the Summary in the DEIS, transfer from one large company to another cannot be defined as diversification of DuPont's economic base. This needs to be rewritten.

Response 14

Acknowledged. The statement has been revised to reflect your comment. The intent of this statement was to recognize the increased revenue that would accrue to the City of DuPont; as a result the city's economic base would become increased in value.

Comment 15

Appendices A and D are prejudicial advertisements.

Response 15

These appendices, clearly labelled as Weyerhaeuser statements, are included to provide information on the company's rationale and decision-making process to those who have requested such information from them.

Comment 16

After "site" on page 133 of the DEIS, add "unless there is an oil spill."

Response 16

It is highly unlikely that amphibians and reptiles would be affected by a marine oil spill.

Comment 17

Regarding line 9 of page xviii of the Summary in the DEIS, say the location at Hawks site would produce the greatest number of anticipated adverse impacts.

Response 17

Identification of adverse impacts throughout the document should be understood to be "anticipated."

Comment 18

The title of Table 26 on page 207 of the DEIS would be clearer if it were "Impacts at Various Site."

Response 18

A new environmental impact comparison for the alternative sites has been produced for the FEIS. See Chapter 6 of the FEIS.

Glossary

ABUNDANT - (As used in this report to describe population density) in excess of 100 organisms per square meter.

ACCRETION - Buildup of land by deposition of waterborne or airborne material.

ADVANCE GRAVEL - A geological unit consisting principally of stratified gravel with some sand, silt and lenses of clay; material deposited in front of the advancing ice sheet by meltwater streams.

AGRICULTURAL CAPABILITY CLASS - Rating from 1 to 10 indicating the suitability of a soil type for agriculture; 1 indicates high suitability, 10 indicates low suitability.

ALKALINITY - Capacity of a water to react with hydrogen ions above pH 4.5, usually an index of bicarbonate and carbonate ion concentrations.

ALLUVIUM - Sedmentary material (mud, sand, etc.) deposited by flowing water within recent geologic time.

AMBIENT NOISE LEVEL - Noise level (intensity) exceeded 90% of the time.

ANADROMOUS FISH - fish that migrate from marine waters up a river to spawn.

ANION - A negatively charged ion.

AQUIFER - Any geological formation that contains water and transmits it from one point to another.

AQUIFER RECHARGE AREA - Surface area where water infiltrates and percolates down into the groundwater.

ATMOSPHERIC STABILITY - Tendancy of air to remain in at given vertical position. High stability occurs when the air at higher elevations is warmer than air near the surface.

AVULSION - Sudden removal of soil be a change in a river's source or by a flood.

BACKGROUND NOISE LEVEL - Ambient noise level.

BATHYMETRY - Measurement of depths of a body of water.

BEACH SEINE - A rectangular net supported at two ends by stiff poles; operated by two persons in shallow, nearshore areas.

BEDROCK - Unbroken solid rock overland in most places by soil or broken rock.

BENTHIC COMMUNITY - Community of organisms living in or on the bottom of a body of water.

BIOMASS - Amount of living matter present at any given time; expressed as number or weight per unit area or volume of habitat.

BIOTA - Collective terms for all plants and animals in an area.

BLUFF - A cliff, headland or hill with a broad, steep face.

CLAY - Soil material that is at least 40% mineral particles less than 0.002 mm indiamter, less than 45% sand, and less than 40% silt.

COBBLE - Rounded and semi-rounded fragments of rock larger than 3 inches in diameter.

COLVOS SAND - A geological unit consisting of sand with included gravel beds and a basal blue-gray silty clay.

COMMON - (As used in this report to describe population density) 2 to 200 organisms per square meter.

dBA - Relative noise intensity measured in decibels, on a scale adjusted to the sensitivity of the human ear.

DELTA FRONT - The sloping area at the face of a delta where deposition and erosion balance.

DEMERSAL FISH - Fish associated with the bottom, e.g., sole, sculpin, ling cod.

DENSITY STRATIFICATION - Stratification of a water body into layers of different density.

DEPOSIT - FEEDING ORGANISM - A bethnic organism that eats organic detritus.

DETRITUS - Fragmented settleable material of inorganic or organic origin.

DISSOLVED OXYGEN - Amount of oxygen dissolved in water; solubility of oxygen in water decreases with increasing temperature and salinity.

DIURNAL TIDAL RANGE - See tidal range, diurnal.

DOMINANT SPECIES - Species that by virtue of abundance, size or habits determine to a large extent that other organisms can use the habitat.

EBB TIDE - The period of tide between high water and the suceeding low water; a falling tide.

EPICENTER - A point, directly above the true center of disturbance, from which the shock waves of an earthquake apparently radiate.

EPIFAUNA - Fauna living on the surface of a substrate.

EROSION - The process by which the land surface is worn away by the action of waves, wind, or flooding water.

ESCARPMENT - A more or less continuous line of cliffs or steep slopes facing in one general direction which are caused by erosion or faulting.

ESTUARY - The part of a river affected by tides; the region near a river mouth in which the freshwater of the river mixes iwth the salt water of the sea.

ETHNOGRAPHIC RECORD - Evidence providing information useful in the analysis of the historical develop of cultures and of the similarities and dissimilarities between the cultures.

EUTROPHIC - Having a high primary productivity as a result of a large suply of available nutrients.

EVAPOTRANSPIRATION - The process of transferring moisture from the earth to the atmosphere by evaporation of water and transpiration of plants.

EVAPOTRANSPIRATION, ACTUAL - The actual amount of water lost by evapotranspiration.

EVAPOTRANSPIRATION, POTENTIAL - The amount of water that would be lost by evapotranspiration if sufficient water were present at all times.

EXTREME HIGH TIDE - Highest tide that may occur at a given location due to gravitational forces.

EXTREME LOW TIDE - Lowest tide that may occur at a given location due to gravitational forces.

FAUNA - Collective term for all the kinds of animals in an area.

FLOOD TIDE - The period of tide between a low water and the suceeding high water; a rising tide.

FLORA - Collective term for all the kinds of plants in an area.

FLUSHING RATE - The amount of time required for the water in a water body to be completely replaced.

FORB - Any herb that is not a grass or grasslike.

FREQUENCY - The number of cycles or completed alternations per unit time of a wave or oscillation.

FRY - The young of fishes

GRAVEL - rounded and semi-rounded fragments of rocks one-eighth to 3 inches in diameter.

GRAVITY WASTING - The process by which large blocks break off the face of a steep slope and fall to its base.

GROUNDWATER - Water beneath the surface of the ground.

HABITAT - The native environment of a plant or animal.

HARDNESS - A measure of the concentration in a water of calcium, magnesium and other soap-precipitation ions.

HERB - A flowering plant whose stem above the ground does not become woody and persistent.

HERBIVORE - An organism that obtains its nourishment by consuming plants.

HIGH TIDE, HIGH WATER (HW) - The maximum elevation reached by each rising tide.

HIGHER HIGH WATER - The higher of the two high waters of any tidal day.

HYDRAULIC HEAD - The amount of pressure exerted by the overlying water column.

HYDROGRAPH - Graph of the rate of flow of a water body as a function of time.

HYDROLOGY - Occurance, circulation, distribution, and properties of the waters of the earth.

INDEX OF DIVERSITY - A measure of the extent to which a community is dominated by a few or many species; numerous formulae have been proposed, including species diversity, species richness, etc.

INFAUNA - Benthic animals that burrow into the substrate at the bottom of a water body.

INFILTRATION - The movement of water through the soil surface into the soil.

INTENSITY (OF SOUND) - Magnitude of energy per unit area or time.

INTERTIDAL REGION - The littoral region above the low-water mark and below the high-water mark.

INVERSION - A reversal in the normal temperature lapse rate, so that warmer air at higher elevation overlies cooler air at the surface, trapping any pollutants emitted near the surface.

ION - An electrically charged atom or group of atoms.

KETTLE - Depression formed by melting of buried piece of glacial ice.

KITSAP FORMATION - A geologic unit composed of beds of fluvial and marsh deposits; it consists of three parts - unoxidized sand and gravel at the base, fine-grained material in the middle (clay, silt, fine sand and some peat), and oxidized sand and gravel at the top.

LENTIC WATER - Standing water; water that is not flowing.

LIQUEFACTION - The state of being liquid; when a soil liquefies (for example during an earthquake), it acts like quicksand.

LITTORAL ZONE - The shallow zone of a body of water where light penetrates to the bottom.

LOTIC WATER - Rapidly flowing water.

LOWER HIGH WATER (LHW) - The lower of the two high waters of any tidal day.

LOWER LOW WATER (LLW) - The lower of the two low waters of any tidal day. The single low water occurring daily during periods when the tide is diurnal is considered to be a lower low water.

LOW TIDE (LOW WATER, LW) - The minimum elevation reached by each falling tide.

MACROALGAE - Algae large enough to be seen without magnification.

MACROINVERTEBRATE - An invertebrate, usually a benthic organism, retained on a U.S. Standard No. 30 sieve (0.595 mm mesh opening).

MACROPHYTE - A plant large enough to be seen without magnification.

MATERIAL CULTURE - The aggregate of physical objects or artifacts used by a society.

MEAN LOW WATER (MLW) - The average height of the low waters over a 19-year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the results to the equivalent of a mean 19-year value. All low water heights are included in the average where the type of tide is either semidiurnal or mixed. Only lower low water heights are included in the average where the type of tide is diurnal. So determined, mean low water in the latter case is the same as mean lower low water.

MEAN SEA LEVEL- The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings. Not necessarily equal to MEAN TIDE LEVEL.

MEAN TIDE LEVEL - A plane midway between MEAN HIGH WATER and MEAN LOW WATER. Not necessarily equal to MEAN SEA LEVEL. Also called HALF-TIDE LEVEL.

MUDFLAT - A mud-covered gently sloping tract of land alternately covered and uncovered by tidal waters.

NERITIC - Of or pertain to the region of shallow water along a seacoast.

ORDINARY HIGH WATER MARK - That mark that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of abutting upland, in respect to vegetation as that condition exists on June 1, 1971 or as it may naturally change thereafter: Provided, that in any area where the ordinary high water mark cannot be found, the ordinary high water mark adjoining salt water shall be the line of mean higher high tide.

PASSERINE - Birds belonging to the order Passeriformes, which typically have feet adapted for perching.

PERCOLATION - Movement of water through the soil

PHREATOPHYTE - A long-rooted plant that absorbs its water from the water table or the soil above it.

PHYTOPLANKTON - The plant organisms in the plankton.

PLANKTON - The community of suspended or floating organisms that drift passively with water currents.

PRECIPITATION - All forms of moisture that fall from the atmosphere, principally rain; also the amount of precipitation.

PRIMARY PRODUCTIVITY - The rate at which radiant energy is stored by photosynthetic and chemosynthetic activity by producer organisms (chiefly green plants) in the form of organic substances that can be used as food by other organisms.

RAPID - Part of a river where the current is fast and the surface is usually broken by obstructions.

RAPTOR - A bird of prey.

RARE - In this report, refers to population density lower than two individuals per square meter.

RECESSIONAL OUTWASH - A geological formation consisting mainly of stratified sand and gravel deposited by meltwater from the receding Puget Lobe of the Vashon glacier.

RECURRENCE INTERVAL - The expected time interval between events (e.g., earthquakes) of a given magnitude; this time interval is a measure of the probability of an event and is based on a long-term average. It does not mean that an X-year event will occur once ever X years but rather that in each, the probability of such an event is 1/X (regardless of the number of years since the last event of that size).

RELICT SEAWATER - Saltwater originally part of some surface water body that has been trapped in a geological formation.

RESIDENT FISH - Fish that do not migrate out the sea but spend their entire lives in a given water body.

RICHTER MAGNITUDE - The intensity of an earthquake as measured on the Richter scale.

RIFFLE - A shallow extending across on a stream bed, causing broken water.

RIPARIAN - Located along the bank of a stream or river.

SALINITY - The concentration of salt (chloride ion) in seawater. Water in the open oceans generally has a salinity of 30 parts per thousand.

SALMON SPRINGS DRIFT - A geological unit consisting mostly of stratified, oxidized sand and gravel, and containing this, discontinuous beds of silt, clay and till.

SALT MARSH - Marsh wet with saltwater or flooded by the sea.

SALT-WATER INTRUSION - Contamination of a freshwater aquifer by a salt-water aquifer.

SAND (By a salt-water aquifer) - Individual rock or mineral fragments having diameters ranging between 0.05 to 2.0 mm; any soil with 85% sand and less than 10 percent clay.

SECOND-CLASS TIDELANDS - Shorelands between ordinary high tide to the line of extreme low tide.

SEDGE - Any of a family of usually tufted marsh plants differing from related grasses in having solid stems and a different type of seed.

SEDIMENTATION RATE - The rate at which sediment is deposited.

SEDIMENT - Fragmented material, both mineral and organic, that is in suspension or is being transported by the water mass or has been deposited on the bottom of the water body.

SEISMICITY - The frequency, intensity, and distribution of earthquakes in a given area.

SILT - Individual mineral particles with a diameter from 0.002 to 0.05 mm.; a soil containing at least 80% silt and not more than 12% clay.

SINUSOIDAL - Having periodic oscillations that can be graphically represented by a sine wave.

SMOLT - Salmon fry at the stage when it migrates out to the sea.

SPECIES DIVERSITY - See index of diversity.

STANDING CROP - The amount of living matter present at any given time, expressed as number or weight per unit area or volume.

STEILACOOM GRAVEL - A geological unit consisting of a consistently coarse gravel, predominantly 1-inch stones with larger stones predominating locally.

STRATIFICATION - Occurring in strata.

STRATIGRAPHY - The arrangement of geological strata.

STRATUM - A sheetlike mass of sedimentary rock or earth of one kind lying between beds of other kinds.

SUBSTRATE - The surface upon which an organism lives.

SUBTIDAL REGION - The littoral region below the low-water mark.

SURFACE RUNOFF - Runoff that moves across the land surface into a stream without percolating into the soil.

SUSPENDED PARTICULATES - Solid particle matter (usually less than 100 microns) that is suspended in air and can be removed by the use of a filter.

SUSTAINABLE YIELD (GROUNDWATER) - Rate at which water may be withdrawn for human use without depleting the supply to such an extent that withdrawal at this rate is no longer feasible.

SWALE - A low place in a tract of land, generally acting as a drainage path.

TAXON - A group or entity within the sytem of scientific classification of organisms.

TIDAL RANGE, DIURNAL - Difference in height between mean higher high water and mean lower low water.

TIDAL RANGE MEAN - Difference in height between mean high water and mean low water.

TIDE FLATS - Flat, usually muddy or marshy area that is alternately covered and exposed by the rise and fall of the tide.

TOTAL COLIFORM LEVEL - Number of coliform organisms present as determined by a standard test; presence of coliform organisms is used as an indicator of contamination by sewage.

TRANSPIRATION - Loss of water vapor through pores in the leaves of plants.

TRY NET - A cone shaped trawl net with a fine mesh designed to catch small fish in open water when towed behind a boat.

TURBIDITY - The reduction of transparency of water due to the presence of finely dispersed solids such as clay, silt, plankton.

UNDERSTORY - The community of low-growing plants occurring below the forest canopy.

VASHON DRIFT - Glacial deposits resulting from the last advance of the Puget glacier lobe into the southern Puget Sound lowland.

VASHON GLACIATION - The last glaciation of the Puget Sound lowland.

VASHON TILL - A geologic unit consisting of compact, unstratified clay, sand, and gravel, locally containing cobbles and boulders.

References

Aerson, A. June 1980. Washington State Energy Office, Fuel Allocation Section, Olympia, Wa. Personal communication.

Alcorn, G., and D.L. Ray. 1970. The future of the Nisqually Delta Area. Memorandum report to Washington State Legislative Council, Commission on Parks and Natural Resources. Response to Resolution No. 70-41 by House of Representatives, State of Washington, Olympia, Wa.

Allen, J. 1981. Seattle City Light, Rates Department. Personal communication.

Anderson, W.W., A.O. Ness, and A.C. Anderson. 1955. Soil Survey of Pierce County, Washington. U. S. Soil Conservation Service, Series 1939.

Anonymous. 1972. Report to the President and Congress on Noise.

Antipa, R. 1979. Washington Department of Fisheries, Olympia, Wa. Personal communication.

Augenfeld, J.M. 1980. Effects of Prudhoe Bay crude oil contamination on sediment working rates of _Abarenicola pacifica_. Marine Environmental Research 3:307-313.

Brown, C., M. Denoyer and D. Meyers. 1974. Marine invertebrates of the Nisqually Delta. _In_ Nisqually Delta, Evergreen College, Olympia, Wa.

Burg, M.E., E.S. Rosenburg and D.R. Tripp. 1975. Vegetation associations and primary productivity of the Nisqually salt marsh on southern Puget Sound, Washington. _In_ S.G. Herman and A.M. Wiedmann, eds. Contributions to the Natural History of the Southern Puget Sound Region, Washington. Unpublished research report. The Evergreen State College, Olympia, Wa. pp. 109-144.

Burg, M.E., D.R. Tripp and E.S. Rosenburg. 1980. Plant associations and primary productivity of the Nisqually salt marsh on southern Puget Sound, Washington. Northwest Science, Vol. 54.

Chapman, V.J. 1976. Coastal Vegetation, 2nd Ed., Pergamon Press, New York.

Chliamovitch, Y.P., and C. Kuhn. 1977 (no title given), J. Fish Biol. 10:575.

Congleton, J.L., and J.E. Smith. 1976. Interactions between juvenile salmon and benthic invertebrates in the Skagit Salt Marsh, Fisheries Research Unit, University of Washington, Seattle, Wa.

Conservation Foundation. 1974. Coastal Ecosystems of the United States - Vol. II, H.T. Odum, B.J. Copeland and E.A. McMahan, eds. Washington, D.C.

Corbett, R.G., and B.M. Manner. 1975. Water quality and potential environmental impact of highway runoff in Ohio, NTIS PB 291-240. Springfield, Va.

Cserjes, A.V., and V.W. Roff. 1964. Retention of pentachlorophenol in lumber dipped in water solutions. Forest Products Research Branch No. P-44, Canadian Dept. of Forestry, Vancouver, B.C.

CH_2M Hill. 1978. DuPont site hydrological and modeling studies. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Crain, O.L. 1978. Assessment of noise emissions from the Weyerhaeuser log export facility at DuPont, URS Company, Seattle, Wa.

Crawford, D.R. 1977. Community noise survey, baseline noise study. DuPont site development. Weyerhaeuser Company, Tacoma, Wa.

Dahlgren, C. 1980. Washington Department of Fisheries, Olympia, Wa. Personal communication.

Dames and Moore, Inc. March 1978. Shallow subtidal benthos of the Nisqually Reach, Puget Sound, Washington. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

DeWalle, F.B., and R.M. Schaff. June 1980. Groundwater pollution by septic tank drainfields. ASCE Journal of the Env. Eng. Div. 106(EE3):631-646.

Duncan, S.H. 1977. Geology and soils of the DuPont site. Weyerhaeuser Company, Tacoma, Wa.

DuPont, City of. 1975. Shorelines master program (required by the Washington State Shorelines Management Act).

DuPont Company. 1980. Letter to URS Company concerning historical site use by E.I. DuPont de Nemours and Company.

Eilers, H.P. 1975. Plants, plant communities, net production, and tide levels: the ecological biogeography of the Nehalem salt marshes, Tilamook County, Oregon. Ph.D. thesis, Oregon State University, Corvallis, Or.

Emlen, J.T. 1971. Population densities of birds derived from transect counts. The Auk 88:323-342.

Environmental Protection Agency. 1979. Water quality criteria, Federal Register 44(44):43666.

Evergreen State College - Nisqually Delta Group Contract. 1974. The Nisqually Delta. Evergreen State College, Olympia, Wa.

Franklin, J.F. and C.T. Dyrness. 1969. Natural vegetation of Oregon and Washington. Forest Research Paper, PNW-80, U.S. Department of Agriculture, Portland, Or.

Freibertshauser, M.A., and A.C. Duxbury. 1972. A water budget of Puget Sound and its subregions. Limnol. and Oceanogr. 17(2):237-247.

Fresh, K.L. 1981. Washington State Department of Fisheries, Olympia, Wa. Personal communication.

Fresh, K.L., D. Rabin, C. Simenstad, E.O. Salo, K. Garrison, and L. Matheson. 1979. Fish ecology studies in the Nisqually Reach area of southern Puget Sound, Washington. Fisheries Research Institute, University of Washington, Seattle, Wa. FRI-UW-7904.

Good, M.L., V.H. Kulkarni, C.P. Monaghan and J.F. Hoffman. 1978. Review of anti-fouling marine coatings and their influence on marine environments. NTIS AD-A053 917, Springfield, Va.

Good, M.L., D.S. Sundee and G. Swindler. 1979. Bioassays and effects of organo-tin marine antifoulants. Proc. of Int. Controlled Release Symp., Academic Press, New York.

Goodwin, C.L. 1973. Subtidal geoducks of Puget Sound, Washington. Technical Report No. 13. Washington Department of Fisheries, Olympia, Wa.

Griffin, W.C., J.E. Sceva, H.A. Swenson and M.J. Mundorff. 1962. Water Resources of the Tacoma. USGS Water Supply Paper, U.S. Geological Survey, Tacoma, Wa. 1499-B.

Hart, Crowser & Associates, Inc. 1976. Preliminary soils and foundation investigation proposed Dupont marine terminal, DuPont, Washington. Report to Weyerhaeuser Company, Transportation Department, Tacoma, Wa.

Hauge, J. 1981. Towne, Richards and Chaudiere, Inc., Seattle, Wa. Personal communication.

Hermann, S.G., and A.M. Wiedemann (eds.). 1975. Contributions to the Natural History of the Southern Puget Sound Region, Washington. Evergreen State College, Olympia, Wa.

Hillis, W.E. (ed.). 1962. Wood extractives and their significance to the pulp and paper industries. Academic Press, New York.

Hitchcock, C.L., and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, Wa.

Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1955. Vascular plants of the Pacific Northwest. Part 5. Compositae. University of Washington Press, Seattle, Wa. 343 p.

Hyland, J.L., and E.D. Schneider. 1978. Petroleum hydrocarbons and their effect on marine organisms, populations, communities, and ecosystems. In Symposium Proc. A.I.B.S. Sources, Effects, and Sinks of Petroleum Hydrocarbons in the Aquatic Environment, U.S. Environmental Protection Agency, Washington, D.C.

Huggins, E. 1833-1859. Journal of Occurrences at Fort Nisqually, Soliday Collection. Available from C.S. Carpenter, Tahoma Research Service, Tacoma, Wa.

Hynes, H.B.N. 1972. The ecology of running water. University of Toronto Press, Toronto.

Irwin, G.A., and G.T. Losey. 1979. Water quality assessment of runoff from a rural highway bridge near Tallahasee, Florida. NTIS PB 298-359, Springfield, Va.

Jackman, S.M., and J.M. Scott. 1975. Literature review of 23 selected forest birds of the Pacific Northwest. U.S. Forest Service, Region 6, Portland, Or.

Jackson, M.S., 1977 and 1981. Environmental administrator, City of DuPont. Personal communication.

Johnson, F.G. 1980. Biological impacts of petroleum: A summary of the current literature. Appendix C. Trans Mountain Low Point Project: Application for Site Certification 79-1. Submitted to Washington Energy Facilities Site Evaluation Council, Lacey, Wa.

Johnson, Pazooki, McMenamin. 1971. Comprehensive planning study for annexation. City of Dupont.

Joslin, M.T.B., 1980. Letter. Materials and Distribution, E.I. DuPont de Nemours and Company.

Keller, M., and S.W. Harris. 1966. The growth of eelgrass in relation to tidal depth. J. Wildlife Management 30:280-285.

Klotz, S., S. Madsen, P. Miller, D. Smith. April 1978. A survey of terrestrial organisms on the Nisqually River Delta, Washington. The Evergreen State College, Olympia, Wa.

Kozloff, E.N. 1973. Seashore life of Puget Sound, the Strait of Georgia, and the San Juan Archipelago. University Washington Press, Seattle, Wa. 282 p.

KPFF. April 1980. DuPont export facility - Solo Point alternative. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Lee, W.Y., and J.A.C. Nicol. 1980. Toxicity of a fuel oil to the eggs of Parhyale hawainensis and Amphithoe valida (Amphipoda). Marine Environmental Research 3:297-305.

Leschi's Bones Reburied, 1895. Tacoma Ledger, Tacoma, Wa.

MacDonald, K.B. 1969. Quantitative studies of salt marsh mollusc faunas from the North American Pacific Coast. Ecol. Mono. 39(1):33-60.

Mearns, A.J., and D.R. Young. 1980. Trophic structure and pollution flow in a harbor ecosgstem. In Coastal Water Research Project Biennial Report for the years 1979-1980, W. Bascom (ed.), Southern California Coastal Water Research Project, Long Beach, Ca.

Merritt, F.S. 1968. Standard handbook for Civil Engineers. McGraw-Hill Book Co., New York.

Merry, W. 1977. Public Relations, Puget Sound Power and Light Company, Seattle, Wa. Personal communication.

Metcalf and Eddy, Inc. 1972. Wastewater Engineering. McGraw-Hill Book Co., New York.

Mills, D. 1980. Letter to Mr. Rudy Thut, Weyerhaeuser Co., Tacoma, Wa.

Mills, D. 1981. Manager, Garrisson Springs Salmon Hatchery, Washington Department of Fisheries, Olympia, Wa. Personal communication.

Milne, L., and M. Milne. 1951. The eelgrass catastrophe. Scientific American 184:52-56.

Morrill, C. 1974. Pink and chum salmon prediction studies, closing report. Suppl. Progress report, Puget Sound Stream Studies. Washington Department of Fisheries, Management and Research Division, Olympia, Wa.

Nautical Weather Service. 1978. Seattle, Wa.

Nisqually Indian Tribe. 1977. Nisqually Indian Community Emergency Regulation 4-77/78.

Nisqually Indian Tribe. undated. Nisqually River Drainage Management Plan. (Provided to URS by Frank Haw, Washington Department of Fisheries, Olympia, Wa.)

Noble, J.B. 1975. Feasibility of a large groundwater supply, Sequalitchew Groundwater Basin, Dupont-Fort Lewis Area.

Nowak, R.M. 1977. Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C. Personal communication.

Oceanographic Institute of Washington. 1977. DuPont navigational risk assessment. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Oceanographic Institute of Washington. 1978. DuPont navigational risk assessment addendum. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Oceanographic Institute of Washington. 1980. DuPont comparative oil spill risk analysis. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Onat, A.R.B. 1976. A Review of available literature and a plan for cultural resource studies at the DuPont site. Report submitted to Battelle Northwest Laboratories, Richland, Wa.

Onat, A.R.B., L.A. Bennett and T. Riordan. 1977. Cultural resources survey - DuPont Site, Volume I. Survey of archaeological and ethnographic resources at the DuPont site. National Heritage, Inc.

Pacific Northwest River Basin Commission - Puget Sound Task Force. 1971. Puget Sound and adjacent waters, recreation, Appendix X; navigation, Appendix VII, plan formulation, Appendix XV.

Pazooki, P. 1977. Memorandum to Mark Jackson, Environmental Administrator, concerning DuPont utilities, City of DuPont.

Pierce County Subregional Council. 1979. Pierce Subregional Development Plan.

Pereia Associates. 1977. DuPont export facility development plan: interim report. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Pierce County. 1974. Shoreline Master Program for Pierce County.

Pine, R. 1972. Memorandum on water quality measurement of Sequalitchew Creek. Washington State Department of Ecology, Olympia, Wa.

Port of Tacoma. 1973, (revised 1979 and 1980). Map of port industrial area - industry location.

Prinslow, T.E., C.J. Whitmus, J.J. Dawson, M.J. Bax, B.P. Snyder and E.O. Salo. 1980. Studies on the effects of wharf lighting on outmigrating salmonids, 1979. Fisheries Research Institute, University of Washington, Seattle, Wa.

Puget Sound Air Pollution Control Association. 1975. Air quality data summary for counties of King, Kitsap, Pierce and Snohomish for 1975. PSAPCA, Seattle, Wa.

Puget Sound Air Pollution Control Association. 1976. Air quality data summary for counties of King, Kitsap, Pierce and Snohomish for 1975. PSAPCA, Seattle, Wa.

Puget Sound Council of Governments. 1977. Goals and policies for regional development. Seattle, Wa.

Ramsey, R.W., (ed.). 1971. Prospectus to retain and enhance the Nisqually Delta as a natural biological laboratory and wildlife refuge. Tahoma Audubon Society, Tacoma, Wa.

Reavis, J.L. 1976. Pittsburg and Midway Coal Company. Personal communication to D.S. Renne of Battelle Northwest Laboratories, Richland, Wa.

Ricketts, E.F., and J. Calvin. 1967. Between Pacific Tides. Stanford University Press, Stanford, Ca.

Salo, E. 1979. Fisheries Research Institute, University of Washington, Seattle, Wa. Personal communication.

Simenstad, C.A., B.J. Miller, C.F. Nyblade, K. Thornburgh and L.J. Bledsoe. 1979. Food Web Relationships of Northern Puget Sound and the Strait of Juan de Fuca. Fisheries Research Institute, University of Washington, Seattle. EPA 600/7-79-259.

Skucy, A.H. (Captain). 1980. President of the Puget Sound Pilots Association. Personal communication.

Soriano, D. (Captain). 1979. Former president of the Puget Sound Pilots Association. Personal communication.

Storie, J.M. 1979. Statements at DEIS public workshop, 12 September, 1979, Tacoma, Wa.

Stratton, D.H., and G.W. Lindeman. 1977. Cultural Resources Survey - DuPont Site. Volume II. Survey of historical resources at the DuPont site. National Heritage, Inc.

Towne, Richards and Chaudiere, Inc. (T.R.C.). 1980. Supplemental noise study for Proposed Weyerhaeuser export facility, DuPont, Washington. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Tacoma Dept. of Public Utilities. 1969. A Comprehensive water supply study and plan for Pierce County and vicinity, Tacoma, Wa.

Teal, J.M. 1962. Energy flow in the salt marsh ecosystem of Georgia. Ecology 43:614-624.

Teal, J.M., and J. Kanwisher. 1961. Gas exchange in a Georgia Marsh. Limnol. Oceanogr. 6(4):388-399.

Thayer, G.W., D.A. Wolfe, and R.B. Williams. 1975. The impact of man on seagrass systems. American Scientist 63:288-296.

Thayer, G.W., and R.C. Phillips. 1977. Importance of eelgrass beds in Puget Sound. Marine Fisheries Review 39(11):18-22.

Thurow, R. 1977. Washington Department of Fisheries, Natural Production Section. Personal communication to Doug Rabin, Fisheries Research Institute, University of Washington, Seattle, Wa.

Thurston County. 1975. Shoreline master program for the Thurston County region.

Thurston County Commissioners. 1976. Planning Staff Memoranda to Board of Thurston County Commissioners Regarding Shoreline Master Program.

Thurston County Planning Council. 1977. Northeast Thurston County Sub-area Plan, Olympia, Washington.

Thut, R.N. 1979. Weyerhaeuser memo to P. White, R. Anderson, L. Robinette. Historical Use of DuPont Wharf. Weyerhaeuser Co., Tacoma, Wa.

Thut, R.N., B.K. Firth, S. Vincent and D. McGreer. 1978. Water quality studies of the DuPont site and Nisqually Reach. Environmental Technology Department, Weyerhaeuser Co., Tacoma, Wa.

Troxel, K.M. 1950. Fort Nisqually and the Puget's Sound agricultural company. Ph.D. Thesis Indiana University. Copy in Washington State Library, Olympia, Wa.

Ulmscheider, H. 1974. Vegetation of the Nisqually Delta. Unpublished research report. The Evergreen State College, Olympia, Wa. 303p. (Available from Prof. A. Wiedemann.)

United States Corps of Engineers. 1975. Washington State environmental atlas, Seattle District, Seattle, Wa.

United States Department of the Army. 1979. Memorandum for record concerning Indian treaty fishing rights--usual and accustomed fishing areas. Office of Council, Seattle District Corps of Engineers, Seattle, Wa.

United States Department of the Army. 1979. Snohomish Estuary Wetlands Study. Seattle District Corps of Engineers, Seattle, Wa.

United States Department of Commerce. 1973. Weather data (monthly normals of temperature, precipitation, and heating and cooling) - 1941 to 1970.

United States Department of the Interior, Bureau of Reclamation. 1977. Western energy expansion study.

United States Department of the Interior. 1976. Endangered and threatened wildlife and plants. Federal Register 41:24062-24067.

United States Department of the Interior. 1970. National estuary study.

United States Department of the Interior, Fish and Wildlife Service. 1977. Repair of dikes and tidegate replacement at the Nisqually National Wildlife Refuge. Environmental Impact Assessment.

United States Environmental Protection Agency. 1979. Damage Assessment Studies Following the NEPCO 140 Oil Spill on the St. Lawrence River. EPA 600/7-79-256.

United States Environmental Protection Agency. 1976. Quality criteria for water. EPA 440/9-76-023.

United States Fish and Wildlife Service. 1980. An ecological characterization of the Pacific Northwest coastal region.

United States Fish and Wildlife Service. 1978. Nisqually National Wildlife Refuge Conceptual Plan.

United States Geological Survey. 1974. Flood profiles and inundated areas along the lower Nisqually River. WRI 42-73. USGS, Tacoma, Wa.

United States Geological Survey. 1976a. Water resources data for Washington, Part 1. Surface water records. USGS, Tacoma, Wa.

United States Geological Survey. 1976b. Water resources data for Washington, Part 2. Water quality records. USGS, Tacoma, Wa.

University of Washington, Dept. of Geological Sciences. 1971. The Nisqually Delta.

URS. 1980 (various dates). Letter and telephone communications between public port districts officials and URS Company, Seattle, Wa.

URS. April, 1980. Heavy metal and hydrocarbon sampling on DuPont shoreline. URS Company, Seattle, Wa.

URS. 1978. DuPont export facility socio-economic impact study. URS Company, Seattle, Wa.

URS. 1977a. Stormwater management procedures and practices. URS Company, Seattle, Wa.

URS. 1977b. SNOMET 208 water quality management plan - Technical Appendix II, Snohomish County, Planning Dept., Everett, WA. URS Company, Seattle, Wa.

USDA. 1979. Soil Survey of Pierce County area, Washington. United States Department of Agriculture, Soil Conservation Service, Washington, D.C.

USDA. 1971. Interpretations of soils for land use planning: a supplement to the Soil Survey of Snohomish County, Washington. United States Department of Agriculture, Soil Conservation Service, Washington, D.C.

USDA. 1958. Soil Survey of Thurston County area, Washington. United States Department of Agriculture, Soil Conservation Service, Washington, D.C.

Walters, K.L. 1971. Reconnaisance of sea-water intrusion along coastal Washington, 1966-1968. Water Supply Bulletin No. 32. Washington Dept. of Ecology, Olympia, Wa.

Walters, K.L., and G.E. Kimmel. 1968. Groundwater occurrence and stratigraphy of the unconsolidated deposits of Central Pierce County. Water Supply Bulletin No. 22. Washington Dept. of Ecology, Olympia, Wa.

Ward, C.E. 1978. DuPont environmental baseline study: air quality impact assessment. Report submitted to Weyerhaeuser Co., Tacoma, Wa.

Washington Department of Ecology. 1977. Oil pollution prevention for non-transportation related onshore facilities. Olympia, Wa.

Washington Department of Ecology. 1977. Water Quality Standards. Olympia, Wa.

Washington Department of Fisheries. 1980. Enhancement report to the legislature.

Washington Department of Natural Resources. 1972. Washington Marine Atlas, Olympia, Wa.

Washington Natural Heritage Program. 1981. Endangered, threatened and sensitive vascular plants of Washington. Olympia, Wa.

Washington Public Ports Association (WPPA). 1975. Port system study for the public ports of Washington State and Portland, Oregon. Vol. II: Technical supplement, Part 2, Port facilities inventory. WPPA, Olympia, Wa.

Washington Public Ports Association (WPPA). 1978. Washington public ports economic study. WPPA, Olympia, Wa.

Washington Public Ports Association (WPPA). 1980. 1980 Port System Study for the Public Ports of Washington State. WPPA, Olympia, Wa.

Washington State. 1971. Shorelines management act RCW 90:58.

Washington State Office of Program Planning and Fiscal Management. 1976. Alternatives for Washington. Olympia, Wa.

Washington State Research Council. 1973. The research council handbook 4th Ed. Olympia, Wa.

Williams, R.W., R.M. Laramie and J.J. Ames. 1975. A catalog of Washington streams and salmon utilization: Vol 1 - Puget Sound region. Washington Department of Fisheries, Olympia, Wa.

Williams, W. 1977. Washington Department of Fisheries, Artificial Production section. Personal communication.

Wilson, S.M. 1977. The present and future Nisqually tribal fishing activities in the Nisqually Area. Letter from tribal biologist to Doug Rabin. Fisheries Research Institute, University of Washington, Seattle, Wa.

Wisseman, R.W., et al. 1978. A survey of the intertidal macro-fauna and flora in the vicinity of the proposed Weyerhaeuser/DuPont deep water port and the adjacent Nisqually Delta. The Evergreen State College, Olympia, Wa.

Young, D.R., T.C. Heesen, D.J. McDermott, and P.E. Smokler. Marine inputs of PCB and copper from vessel antifouling paints. NITS PB-275 412, Springfield, Va.

DATE

ILME

— 8